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THE LEVEL OF STUDENT-FACULTY CONTACT IN THE CLINICAL YEARS OF UNDERGRADUATE MEDICAL EDUCATION

by

©

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled

THE LEVEL OF STUDENT-FACULTY CONTACT IN THE CLINICAL YEARS OF UNDERGRADUATE MEDICAL EDUCATION

submitted by MICHAEL H. NUSBAUM

in partial fulfilment of the requirements for the degree of Master of Health Services Administration.

ABSTRACT

In order to obtain an objective measure of student-faculty contact during the clinical years of the University of Alberta's undergraduate medical education program (third and fourth year), a contact-time survey was conducted during the 1975-1976 academic year.

Students were selected for each week of the study period (fifty-two weeks) by a probability sampling method, and requested to fill out time sheets for the one-week block. In addition, the respondents were also asked to estimate, from their point of view, the percentage of "instructional component" for all contact activities. Employing an appropriate weighting mechanism to reflect unequal probability sampling and non-responses, the results were tabulated with respect to faculty-hours per year as well as student-hours per week. Each tabulation was further broken down by participating hospitals, department types, and types of activity.

This study has attempted to provide a base of data with which to examine the relationships of student contact with faculty during the clinical years of undergraduate medical education at the University of Alberta.

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INTRODUCTION

Medical education is heavily manpower-oriented, and requires scarce and expensive human resources. As a result, effective methods must be employed to enable these resources to be utilized to their fullest extent. Studies measuring manpower workload are often used in industry for the purpose of obtaining information pertaining to manpower requirements. However, due to the high degree of specialization and the professional nature required of educators, and due to the involved interactions between educators and students, it is generally known that work study methods have been difficult to adapt to the educational field, especially in professional programs such as medical education.

1.1 Statement of the Problem

Recently, there has been a "budget squeeze" trend across all publicly-supported institutions and programs, including medical schools. This has generated immediate pressure for administrators to review their staff resource requirements, and either justify the present level of staffing, or examine alternatives to present resource

allocations. The present study was initiated with the objective of measuring the level of teaching activity between the medical undergraduate students and the faculty. More specifically, an attempt was made to investigate the utilization level of staff resources, and to measure faculty-student interaction in terms of contact time between faculty and students, with the intention that such data would assist administrators in their review of staff allocations.

However, it must be noted that this thesis examines merely what was (and is) <u>currently underway</u> within the undergraduate medical student-internship program at the University of Alberta, and was not designed to compare an observed level of instructional activity with an "adequate or desirable" level of instructional activity. It was, however, a first step in reviewing the manpower-effectiveness of the Faculty, and in providing a data base which, when synthesised with other sources of information, could be a useful aid for manpower planning, and possibly in allocating funds.

1.2 Need, Demand and Utilization

Ideally, any rational approach to resource allocation in a service industry must be based on an assessment of the needs of the population served. However, in practice, one

may face three types of measures often associated with resource allocation problems: that is, need, demand and utilization. These concepts are certainly not identical nor mutually exclusive, and much theorizing has been attempted to try and answer the question: "What exactly is it that is being measured?" Donabedian (1973, pp.58-70) has put forward a theory describing the relationships between need, demand and utilization in the medical care setting.

The author will not, however, attempt to discuss the sociological implications of need, demand and ultilization in this thesis, other than to point out that the allocation and distribution of human resources should ideally be based upon measurements obtained on true system needs. However, seldom is adequate information available, nor is it possible to obtain at reasonable costs.

In light of this, and only as a first step in the resource allocation process, the present study is of a descriptive nature, and attempts only to identify aspects of utilization. As a result, the opinions of students and faculty as to the required (or desired) amount of interactions are not measured in this study. What is being measured are students' perceptions of their interaction with, or utilization of, available instructional resources.

1.3 Background to the Problem

At the University of Alberta, allocations of funds to faculties and schools are usually associated with utilization measures such as "student-hours" and "contact-hours" (Institutional Research and Planning, 1970). These measures are determined from the Registrar's tabulations of student enrollment, which in most cases consist of allocations for formal lectures, seminars, and laboratory sessions. Following the application of a pre-determined formula, a basis for discussion and allocation of the University's resources among faculties and schools is then available to the Board of Governors.

In applying measures such as student-hours and contact-hours across the entire spectrum of faculties and schools, one must assume that the instructional time requirement for student-activity (ie. need) is approximated by the above utilization measures which are within certain margins of tolerable errors. However, within the Faculty of Medicine, third- and fourth-year undergraduate medical students (Phase III) undergo much less formally-structured activities. Instruction for these students occurs almost exclusively within the clinical environment, mostly in hospitals, as part of Rotation and Elective programs. Rotations and

Electives infer active involvement, on the students' part, in dealing with real patients, and in this respect, training takes on the form of "apprenticeship", or more specifically, on-the-job instruction. This deviates considerably from those activities experienced by most other students at the University, and as a result, it is very difficult, if not impossible, to obtain universal need and/or demand measures using the same criteria. In addition, where other faculties and schools employ mainly full-time professors, lecturers and teaching assistants, the undergraduate student intern program utilizes the services of many part-time faculty members [physicians, residents, and rotating interns] to complement the services of its full-time faculty. As a result, teaching activities are diluted by physicians' practices, hospital services, research and other activities.

1.4 The Pilot Study

In the Spring of 1975, a feasibility study of Phase III faculty-student contact time was designed [Grady, W., Makowsky, M., Mitchell, I., Teixeira, C., 1975]. This pilot study was conducted to test the applicability of two alternate research instruments. Based on the pilot study, it was recommended by its authors that such a study be carried out. Furthermore, a positive reaction by the Phase III students of the Faculty of Medicine was indicated by the results of an opinion survey of the respondents. The

students' opinions indicated that the research instrument's instructions were clear and concise, that the instrument used to collect the data was relatively easy to fill out, that it took less than five minutes per day to do so, and that the students did not object to completing a weekly time-sheet 3-4 times per year.

1.5 Objectives of the Study

Based on the findings of the pilot study, the present investigation was undertaken with the objective of estimating Phase III faculty-student contact-time as reported by the students. More specifically, the author attempted to derive a utilization measure of faculty resources, namely:

(1) To estimate the actual amount of faculty-student contact-time over both Rotation and Elective activities,

(2) To compare contact-time amongst participating teaching hospitals and departments,

(3) To estimate and compare the amount of direct instruction received by the students in the various hospital departments, as perceived by the students themselves, and

(4) To evaluate the methodology used to extract the above information from the students.

1.6 Scope of the Study

The study focused on the direct contact time between Phase III medical students and their faculty counterparts. The time frame of the data acquisition phase was from September 4, 1975 to September 2, 1976, giving a total of 52 calendar-weeks.

The study was limited to those students participating in the Rotation and Elective programs, and subsequently reflected upon only those faculty members and other resource personnel directly involved with the programs.

The following Alberta hospitals were included for regular Rotation:

(1) University of Alberta Hospital
(2) Royal Alexandra Hospital
(3) Edmonton General Hospital
(4) Misericordia Hospital
(5) Alberta Hospital (Oliver)
(6) Charles Camsell Hospital

Furthermore, departments within hospitals were limited to Medicine, Surgery, Obstetrics and Gynecology, Paediatrics, and Psychiatry. The activities of Medicine were divided into two sequential groups, owing to the large curricular load, and were denoted by Medicine I and Medicine II. In addition, Elective activities were measured as if they were grouped as

a unique department.

Faculty-student contact time was restricted to direct instructional activities. This implies that casual, non-instructional contact by the students with faculty members was not included in the study.

1.7 Methodological Limitations

The following were limitations encountered by the author in carrying out the study:

(1) The study methodology was somewhat constrained because there was little prior information available to construct an "optimum" sampling design.

(2) Conceptually, it is more desirable to obtain information pertaining to manpower requirements by way of a normative, rather than a descriptive study. However, due to the lack of desirable standards, and due to measurement difficulties, the study attempted to measure what was happening at the time, and was not designed to compare the results with what was supposed to be happening, nor to make value judgements. Furthermore, items relating to the quality of instruction were intentionally omitted from the instrument. Nevertheless, an attempt was made to quantify the instructional component, but admittedly, the method is

limited and subject to criticism.

1.8 Definitions Pertaining to the Study

The following is a list of definitions of terms used throughout this thesis:

1. Phase III Student:

   A student registered in the Faculty of Medicine at the University of Alberta, who is undergoing his/her third or fourth year of undergraduate study.

2. Student Contact Time:

   The time spent in sessions during which Phase III students are observing or receiving instruction under direct supervision of one or more preceptors and/or other medical staff, including residents and interns. Direct supervision is defined as contact during which both the faculty member and the student are within eyesight of one another.

3. Student Week:

   A period of seven consecutive days, starting Thursdays at 9:00 A.M., spent by a Phase III student as a part of his/her formal rotation or elective schedule. Thursdays were chosen as the commencement of a rotation or elective to coincide with the schedule assigned by the Faculty of Medicine.

4. Per Cent Instructional Component:

   The proportion of activity relevant to instruction, <u>estimated</u> by Phase III students, for any contact activity. This is a quantitative measure only, and is not intended to reflect any qualitative aspect.

5. Contact Activities:

   Regular, direct activities through which a

Phase III student experiences potential contact with preceptors and other staff involved in the Phase III program. Examples of Contact Activities are: ward rounds, admissions review, clinical rounds, operating room sessions, clinics, seminars, lectures, and night calls.

6. Rotation and Elective Week:

One out of several weeks required of (rotation) or selected by (elective) a student to formally spend in a particular hospital and department as a student intern.

7. Calendar Week:

Concurrent with a Rotation or Elective week, but with respect to the study time frame. For example, Calendar Week #1 was from September 4, 1975 to September 11, 1975.

8. Cohort:

Students receiving Phase III instruction as a group. In this study, groups were surveyed during a 4-, 6-, or 8-week period [depending upon the Rotation or Elective schedule].

1.9 Summary of the Thesis Format

A review of pertinent literature will be found in Chapter 2, followed by a presentation of the study methodology in Chapter 3. Results and interpretations are discussed in Chapter 4, and the summaries, conclusions, and recommendations are presented in Chapter 5.

Chapter 2

THE APPLICATION OF OPERATIONS RESEARCH IN MEDICAL EDUCATION: A LITERATURE REVIEW

The concept of operations research (often called systems analysis or management science)[1] has been a part of modern management for most of the past decade (Wagner, 1969). The literature is saturated with examples of how operations research has been used to increase efficiency, reduce operating costs, and optimize resource allocations in the private, and some public sectors of the economy. Governments and other public bodies have found operations research useful in enabling large departments to operate in the face of escalating costs and constrained budgets. As the level of technology increases in all aspects of public and private enterprise, the need for rational management decision-making becomes essential in maintaining efficient provision of goods and services and control of costs. To

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[1] Strictly speaking, these refer to different methodologies, but substantial components overlap and are quite often used interchangably. For example, Connors(1975) "...doubts whether much concensus could be achieved on definitions of such crucial terms as operations research, systems analysis, systems engineering, management engineering, industrial engineering, system, output, input, process, and so on [p.22]."

this end, operations research has become an established and widely-used aid.

Although fairly new to the management of health care services, operations research has been utilized frequently in the past decade. The purpose of this chapter is to review the pertinent literature of operations research, time-study, and manpower-planning, as well as to illustrate their applicability to research in medical education.

2.1 Operations Research

Due to the potentially widespread applicability of operations research, there exists no universally agreed-upon definition of this relatively new discipline. Attempts have led to generalities such as "the scientific approach to decision-making that involves the operations of organizational systems" (Hillier and Lieberman, 1970, p.5). Koza (1973) suggests ".. a very general definition of operations research may be stated as ...the application of scientific methods, techniques, and tools to problems involving the operations of systems solutions to the problems [p. 1]." And Wagner (1969), "for convenience", defines operations research as "a scientific approach to problem-solving for executive management [p. 4]."

Although the definitions may vary substantially, the following keywords seem to be quite common: science, mathematical model, decisions, systems, and management.[1]

Hillier and Lieberman (1970, p.5) maintain that the best way of examining the nature of operations research is to outline its characteristics. First of all, the breadth of applications is unusually wide, including business, industry, the military, civil government, agencies, and hospitals. Secondly, the approach of operations research is that of the scientific method; specifically, the formulation of the problem and the construction of a scientific (typically mathematical) model that attempts to abstract the essence of the real problem. Experimentation is the third phase: testing the applicability of the model to the problematic reality (often by simulation methods), followed by the formulation of conclusions by the decision-makers when they are needed. Hillier and Lieberman (1970) summarize by stating that "operations research involves creative scientific research into the fundamental properties of operations... [and concerns] the practical management of the organization [p. 5]."

Wagner (1969, p. 5) refuses to accept operations

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[1] The author does not attempt to discuss systems theory or decision theory in this text. Interested readers are invited to consult Churchman, C.W., The Systems Approach, New York: Delta, 1968.

research as an approach to problem-solving unless it contains certain qualities: (1) a primary focus on decision-making, (2) an appraisal resting on economic effectiveness criteria [i.e. costs, revenues, cash flow, rate of return, etc.], (3) reliance on a formal mathematical model, and (4) dependence on electronic computers [to facilitate complex computations and large volumes of data].

A study in 1965 (Schumacher and Smith, 1965) provided an overall picture of operations research activities in private industry at that time. The primary activities included forecasting, production scheduling, inventory control, quality control, transportation, advertising and sales research, maintenance and repairs, accounting procedures, plant location, equipment replacement, packaging, and capital budgeting.

2.2 Time Study

One specific application of operations research is time-study. Niebel (1973) defines time-study as "the technique of establishing an allowed time standard to perform a given task, based upon measurement of work content of the prescribed method [p. 6]." Techniques useful to time-study include stopwatch study, standard data, fundamental motion data, work sampling, and estimates based on historical data (Niebel, 1973, p.6).

Modern time-study began in 1881, as a result of the efforts of Frederick W. Taylor, considered to be the father of the scientific management movement. By 1917, many industrial plants had adopted Taylor's "shop management" techniques with considerable success in increasing efficiency (Thompson, 1917).

Men such as Frank Gilbreth, Carl Barth, Henry Gantt, and Morris Cooke contributed to and developed Taylor's original ideas, and by World War II, time-study in its contemporary form was a well-established analytical procedure in the United States. Since then, many associations have been formed for the express purpose of "bringing the science of time-study... up to present-day standards [Niebel, 1973, p.15]".

However, the current trend is tending to de-emphasize scientific management techniques, and is moving more towards a management science approach. For example, authors such as Churchman (1968) have recently questioned the benefits of scientific management techniques, on the grounds that the "human aspect" has been neglected, and the system's goal has not been "optimized" [i.e. efficiency but not effectiveness]. It is generally agreed upon that time study is difficult to apply to industries of a service nature, such as in medical education, due to the manpower-intensiveness and the dominance of human relations.

2.3 Operations Research and Health Care

The health care industry has not escaped the rapid evolution of technology. Wanielista (1970) is quite correct in observing that "with the increased use of scientific techniques in management, the health care administrator is finding a new environment in which to conduct his planning and operations [p. i]". He goes on to say that operations research has gained the acceptance of the profession in health care planning, medicare administration, and medical research (on the macro-level), as well as in work simplification and manpower-planning (on the micro-level). Koza (1973) points out that:

> ...today's health administrators must learn to use the quantitative information that can be provided by mathematical and operations research techniques as an aid in the decision-making process [p. 1].

The use of management science approaches in health manpower studies was frequent during the 1950's and 1960's. During this time period, the bulk of operations research projects involved time studies of nursing activities and detailed analyses of the functions of professional nurses (Levine and Kahn, 1975, p.338).

Young (1975, p.xi) has stated that since the early 1960's, the amount of research effort in health has increased exponentially. However, beyond a few initial analytical breakthroughs, the potential of operations

research in health care has perhaps not been as fully realized as might be expected.

Management scientists have begun to exercise caution in the "blind" use of operations research techniques in the health care field. As in any social science research, they must deal with complex human behavior which present challenging measurement problems. Authors agree that operations research is but a guideline, a mere aid to management in decision-making, and should never be relied upon entirely. Stimson and Stimson (1972) argue that operations research has been less than enthusiastically received amongst health care [especially hospital] administrators. The major difficulties in the implementation of operations research studies in hospitals have been identified as the following:

> 1. Omission of some problems deemed important by administrators, such as quality of care, continuity of care, and hospital-community relationships.
>
> 2. Tendency to view the hospital as a separable system, whereby interrelations between parts of the organization are neglected.
>
> 3. Tendency to view the hospital solely as a mechanistic system, failing to identify it as a sensitive social system as well.
>
> 4. Lack of attention to model-building and to the way data for models are generated.
>
> 5. Omission of variables that are difficult to quantify, such as the quality of patient care. [Stimson and Stimson, 1972, pp.41-64]

Nevertheless, Stimson and Stimson are not entirely opposed to the use of operations research in the health care sector: "The challenge for operations researchers is to develop theory and methods for studying in a holistic manner the complex system that is the hospital [Stimson and Stimson, 1972, p.83]."

2.4 The Need for Research in Medical Education

The major human resource in the health industry is, of course, the physician. It stands to reason, therefore, that improvements made to programs of physician training will ultimately reflect upon improved health care in the general sense. In a report to the Ontario Council of Health on Health Manpower (1969, p.83), it was revealed that, with the continuing trend of admitting more Canadians into medical schools each year, and despite the reduction of physician immigrants to Canada (49% of newly-registered physicians were immigrants in 1968), by 1986 Ontario would boast one physician for every 900 Ontario residents. The report urgently recommended a program of study and planning for health education.

The steady increase of costs to the taxpayer required to educate physicians indicates a strong need for intensive research. In 1968, the average expenditure per medical school in the United States was $5.5 million, as compared with $2.6 million in 1961 (Entwisle, 1971). Should present

trends continue, it is forecasted that, by 1980, the average annual expenditure per medical student will approach $44,000 (Entwisle, 1971).

The average annual cost of educating a Canadian medical student in 1967 was $4,925 for undergraduates, and $8,827 for graduate students (Association of Universities and Colleges of Canada, 1970, p.161). At the University of Alberta's Faculty of Medicine, the 1970 cost per undergraduate student in each of the four years of study was $5,033., $3,292., $5,958., and $6,084., respectively (Institutional Research and Planning, 1971, p.168).

It should be noted, however, that the U.S. cost figures are not directly comparable with the Canadian figures. This is partly due to the different financing mechanisms governing health care delivery in the two countries. Although all the cost information is well-documented, the assumptions made in the calculation of the values are not. Therefore, the reader must consider the figures separately, and not attempt to make direct comparisons.

The interrelation of systems can be illustrated in the cost of medical education. As Foster (1972) points out, "medical education will continue to be heavily patient and hospital centred, and as long as this is true the hospital will continue to be a teaching as well as a service institution [p. 9]." What is implied is that the hospital

must share in the burden of financing medical education, and that the patient is an indirect contributor. In Canada, the per patient operating costs of a teaching hospital are twice those of a non-teaching hospital (MacFarlane, 1964, p.122), and the situation seems to be quite similar in Britain (Hill, 1968, p.117). Although case mix differential may account for a substantial portion of this difference, it can be postulated that the educational component is indeed a factor responsible for increased costs.

Vodev (1957, p. 107) advocates that every effort should be made to transfer education costs from the patient to broader community support. This is already the case in Canada, due to universal medicare and government support of hospital costs.

2.5 Evaluation Studies in Medical Education

The use of on-going evaluation techniques has been deemed an essential control mechanism in adapting to a changing technological and social environment. On a micro-level, evaluation serves as a decision-making tool: "...[an] instrument for making wiser choices from a set or sets of alternatives that are outgrowths from what has occurred and what is to follow ...a commitment to better quality control of the end product [Blain, 1972, p.16]."

Education, in general, has historically seen much

attention devoted to the development and use of evaluation techniques. For example, examinations evaluate students' achievement; "course evaluations" assess teachers' performance; and accreditation teams evaluate academic standards of teaching programs. Although some significant progress has been made in educational and psychological measurement [especially in the area of aptitude tests], the evaluation has not been any more successful in education than in other social programs.

Medical faculties at universities have also been subject to much evaluative research covering a broad spectrum. For this purpose, as well as to satisfy other management needs, a medical school must supply information on a broad range. Kutina and Lee (1973) have defined a basic set of data-base requirements for a medical school information system. Aside from financial and budgetary data, the authors included data of personnel effort, curricula, facilities, and student activity. This system was implemented at the School of Medicine, Case Western Reserve University, with the purpose of strengthening the ability of the administration to plan and manage the affairs of the school. The project determined that the information gathered was most adequate "for external reporting, day-to-day internal operating, and fiscal auditing purposes [Kutina and Lee, 1973, p.803]." Unfortunately, no comments on the implications for planning and allocating resources were

reported.

Blain (1972) and members of the Educational Resources Group, School of Medicine, University of Missouri at Columbia, conducted studies on medical educators, health care education professionals, and medical and health care students. One of the specific projects included the mailing of questionnaires to students, and this proved useful in determining feedback regarding the quality of courses and instruction.

Among the many documented resource planning information systems currently in use in educational institutions, there has recently appeared interest in the development of health education planning models. Systems such as CAMPUS, HELP/PLANTRAN, RRPM, and SEARCH have been developed to help "predict cost and resource requirements by analyzing the forecast enrollment by discipline and assessing the impact of alternative planning policies [Systems Dimensions Limited, 1974, p.70]". However, because the emergence of systems planning models has occured only in relatively recent years, there still exists some concern over their practical application.

The Faculty of Medicine at the University of Alberta has, in the past, attempted to estimate faculty teaching workload using survey techniques. Two studies were conducted, the first occuring in April of 1971, and the

second during the 1973-1974 academic year. Both studies resulted in unsatisfactory estimates of staff teaching workloads, due mainly to lack of committment by the faculty respondents (poor response rate), and apparent overestimates provided by the responding faculty members.[1]

It should be noted the above studies, as well as the majority of those found in the literature, measured utilization through response from faculty-members. Hilles (1973) attributed the shortcomings of faculty effort-reporting to:

> (1) The stigma which effort reporting carries [a time-clock-punching connotation].
>
> (2) Lack of objectivity in separating the teaching component from the service component.
>
> (3) Bias is inherent in the effort technique which varies with the source of the faculty's salary. If a faculty is supported mainly from research funds, one would expect bias to exhibit a high proportion of time to research.
>
> (4) The subjectivity of the effort reporting technique in that faculty must provide estimates of effort [p. 806].

Stoddart (1973) identified a major weakness in faculty questionnaire reporting, that being the tendency of

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[1] This information was obtained in a series of conversations between the author and Mr. H. Fearon, Office of the Dean of Medicine, Faculty of Medicine, University of Alberta.

individuals to reflect upon their most recent pattern of activity. The characteristic low response rate from faculty members precludes the use of on-going measurement techniques.

Most researchers agree that, in order to obtain accurate information, faculty-respondents must be able to separate teaching activities from all other activities, and in this respect, most studies have proved unsatisfactory (Smythe, 1970; Hilles, 1973; Stoddart, 1973).

2.6 Medical Clerkships and Faculty-Student Contact

Until recently, senior medical students followed a fairly structured curriculum format. J.A. MacFarlane, then the director of the Royal Commission on Health Services, identified the shortcomings of this format type, and proposed a somewhat radical change:

> In most Canadian schools, the final year students are given only limited responsibility... they are being taught most of the day, rather than being left on their own with the faculties for supervised learning on the wards and in the libraries and laboratories [MacFarlane, 1961, p.270].

Some years later, when the Commission published its report on Medical Education in Canada, MacFarlane noted that medical schools in most countries other than Canada utilized what was commonly called the "Block System". Under this system, a student is assigned to a hospital service, and

actually becomes a part of that unit with definite responsibilities. All of the student's time is devoted, for a designated period, to studies in that particular area and to the activities of the unit (MacFarlane, 1964, p.80). The Commission made its recommendation:

> We think that the student, during his final year, is sufficiently mature to do much of the work that is now allocated to the so-called 'rotating intern' in the teaching hospital... the student could be assigned to this duty as a clinical clerk [MacFarlane, 1964, p.81].

The "Block System" has since been adopted in Canadian medical schools, including that of the University of Alberta, and has been operating successfully for several years. However, because the clinical clerks are only partially supervised, it has been difficult for the medical school administrators to evaluate the program in terms of curriculum, faculty effort, and student performance. As Murphee (1972) states:

> Maintaining regular faculty contact with the students during the clerkship requires both travel time and funds. Implementing a successful evaluation of such a dispersed program demands minute planning and preparation of paper work [p.930].

Evaluation of the so-called "clinical experience" of the clerkship has been focused upon "...the qualifications, motivation and attitudes of the clinical supervisor... [and] the ratio of clinical supervisors to students" (Enright, 1972, p.159). Two studies, presented in the following sections, have recently been attempted in Canada with the

purpose of evaluating faculty-student contact in clerkship programs. One study asked faculty members to report on contact activities, and the other evaluated responses from the students regarding contact activities. A third study is also presented illustrating a complex sampling methodology used to investigate physician-patient contact time.

2.7 The FPTU Study[1]

Stoddart (1973) and his associates designed an activity reporting methodology to be employed "as part of an overall methodology of a cost analysis of the Family Practice Teaching Unit (FPTU) of the University of British Columbia Department of Health Care and Epidemiology [p. 820]." The objectives of the unit, as defined, were:

> (1) To provide educational experience for health science undergraduates as well as first- and second-year residents in family medicine.
>
> (2) To supply primary health care to families in the community [p. 820].

The overall objective of the study was to determine the costs of the education and patient care functions of the unit.

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[1] A discussion of the results of this study can be found by consulting Stoddart, G.L., "Effort Reporting and Cost Analysis of Medical Education", Journal of Medical Education, 1973, 48(9), 814-23.

Activity reports were completed by all non-student FPTU personnel (sample size was 31) on the basis of the preceding year's work. Respondents were asked to estimate the percentage of time spent in the following procedures:

(1) Patient contact without students.
(2) Patient contact with students present.
(3) Direct contact with students (no patients present).
(4) Conferences
(5) Rounds
(6) Administration
(7) Clerical functions
(8) Self-Education

In addition, the respondents classified the activities into three categories: patient care, education, "other", or some combination of each (reported by percentage).

The activity reports were reviewed with each respondent by a "knowledgeable observer", mainly to ensure 100% response taking into account the small sample size. Both Stoddart and Hilles (1973) identified the tendency of respondents to reflect only upon their most recent pattern of activity, despite the fact that the information collected was to represent the activities of the entire preceding year.

The data collected from the activity reports was used to attribute direct salary expense for each individual to the education and patient care functions, as well as to establish allocation criteria for supply expenses and general overhead.

Amongst the sources of error in the study was the confusion of the respondents over "conferences" and "rounds". Stoddart (1973) recommended the amalgamation of the two categories in future studies of a similar nature. In addition, it was found that respondents "found it more difficult to estimate the percentage of their time spent on procedures than to divide the percentages up among the three activity categories [p. 822]".

Stoddart suggested that the study might be repeated, including the health science students in the reporting process. The rationale behind this was to provide estimates for opportunity costs (the value of the students' time) and replacement costs (the cost of hiring persons to perform the work currently done by students).

The investigator concluded his report with the assurance that, although his study only provided subjective estimates, his activity reporting technique "produces more accurate estimates of the relative costs of patient care and education in clinical teaching settings than would otherwise be obtained [p. 823]."

2.8 The ACMC Study[1]

Entitled "Evaluation of clerkship in Canadian medical schools", a research project was initiated by the Association of Canadian Medical Colleges (ACMC) during the 1975/76 academic year. The study evolved as a result of conflicting opinions as to the value of the clinical clerkship (or undergraduate clinical training) vis a vis the rotating internship (post-graduate). Many believed the educational value of the clerkship is superior to that of the internship, others believed it to be equivalent, and still others, inferior.

In addition, discussions were underway regarding licensing requirements, especially those in family practice. Some considered one, two, or even three years of residency necessary for licensing, however many students wrote [and passed] their licensure examinations even before they began their post-graduate training.

As a result, the ACMC initiated the research project with the objective of evaluating the clerkship programs across Canada, and their implication for post-graduate training. The project format took on two phases: (1) daily

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[1] During the time the ACMC study was in progress, all information was obtained through correspondance with Dr. Guy Lamarche, Association of Canadian Medical Colleges, 151 Slater St., Ottawa, Ontario K1P 5H3.

activities of the clerk, and (2) on site visits of all [16] schools.

Of the 1768 clinical clerks registered in Canada in 1975/76, approximately 530 were selected as respondents. This was accomplished by asking each medical school to select, without guidance, a random sample of 30% of their clerks. All selected clerks were required to complete a booklet of minute details, for a period of three weeks.

Each respondent was asked to report the design of his/her clerkship program, including the number of weeks [and the location] of each required Rotation and each selected Elective. In addition, for every half-hour period during the three weeks, the respondent was requested to report details on activities, setting, format, and evaluation. The suggested activities included:

(1) history taking
(2) physical examination
(3) operating room work
(4) emergency room work
(5) laboratory work
(6) out-patient work
(7) grand round
(8) lecture, seminar, or tutorial
(9) breaks (coffee, lunch, dinner, holiday, travel)

A setting was defined as follows:

(1) wards
(2) operating room
(3) emergency room
(4) doctor's office
(5) lecture theatre
(6) automobile

Format was meant to include:

(1) alone
(2) with patient
(3) with intern (or teacher, resident, nurse..)
(4) small or large groups

For the section on evaluation, the respondent was requested to rate each activity on a scale from 0 to 4 in terms of the educational value of that activity. A score of 0 indicated no value, and a score of 4 implied excellent educational value.

The ACMC study was coordinated at each school under the auspices of the clerkship program director. The random selection of the 30% sample became his responsibility, and the selection method inevitably differed from school to school. In addition, all respondents were asked to report during the same three-week period. This procedure failed to take a time factor into account, and merely provided a crossectional account of clerkship activities across the country over the designated three weeks.

Phase II, or the on site visit stage, included interviews with:

(1) clerks
(2) clerkship program directors
(3) faculty members
(4) interns
(5) residents

The purpose behind the interviews was to gather information

on clerkship design, and to evaluate the students and faculty. Aside from the interviews, the investigators studied and evaluated the patient records prepared by the clerks.

Unfortunately, the ACMC study was terminated in the early months of 1977 before any results were published. The reasons for the cancellation were identified as inadequate preparation of the study instrument, and poor study response, leading to incomplete and erroneous data collection.[1] The ACMC is currently attempting to revitalize the study instrument for a possible second study tentatively scheduled for 1981.

2.9 <u>The Saskatchewan Psychiatric Patient Classification Study</u>

Bay et al. (1974) designed a sampling procedure to be used for the Psychiatric Patient Classification Study conducted by the Hospital System Study Group, University of Saskatchewan, Saskatoon, Saskatchewan. The purpose of the study was to estimate direct patient care time. More specifically, the study attempted to measure the direct care time provided by various health professionals for the

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[1] This information was obtained by telephone conversations with Mrs. S. Deschenes, Association of Canadian Medical Colleges.

psychiatric patient in an effort to validate a patient classification system developed by the Hospital System Study Group (Sjoberg, K. and Bicknell, P., 1968). Rather than discuss the study results, the author will attempt to highlight the significant aspects of the sampling methodology.

The sampling design was of a multi-stage, stratified cluster variety, and involved the selection of week-days, shifts, patients, and time-segments for the observation of patient activities by the observers. Four hospitals were selected for the study on a non-probability sampling basis, one from each of the four Western Canadian provinces. Target populations were defined for each hospital, and the study frame was set at six consecutive weeks.

The sampling elements were defined as segments of time elapsed for each patient, or patient-hours. The population was stratified by shift (day, evening, and night), by patient-care category (minimum, average, above average, and intense), and by day of the week. A number of patient observation periods, or patient-shifts, were selected for observation, and each patient-shift constituted a cluster, consisting of patient-hours over an eight-hour shift.

Selection of the sample was three-stage. In the first step, a number of weeks out of a possible six were chosen. The second stage involved the selection of patients from

selected weeks by a simple random sampling technique. The last stage of selection was that of observation time out of a possible eight hours per shift. To reflect unequal probabilities of selection, weights were applied to the data at all three sampling stages to obtain unbiased estimates of the population total, and eventually to obtain mean direct care time per patient shift for each class of patients. For selected time periods, both patients' activity and contact with health professionals were recorded by the independent data collector.

The analysis of the data took on two forms: (1) Type A analyses estimated the total time spent by the staff, while (2) Type B analyses were concerned with the total time the patients spent with the staff.

The study design used in this Phase III study partially resembled that described in this section. A major difference between the two was that the Saskatchewan study employed outside independent observers for actual data collection, while the Phase III study relied on self-recording by the students. A detailed description of the Phase III sampling scheme will be discussed in Chapter 3.

2.10 Some Basic Concepts of Sampling

In this section, the essential elements of sampling theory are reviewed in relation to the present study. These

can be found in most elementary text books on sampling theory, such as Cochran(1966), Deming(1966), and Raj(1972).

2.10.1 Sampling Terminology

Aside from those definitions found in Section 1.8, the following is a list of terms generally used in conjunction with sampling theory and application (Raj, 1972):

1. Population:

    A group of objects, or attributes, such as persons, establishments, or other items. A population is finite if the number of objects or units contained in it is limited. Most of the populations dealt with by survey researchers are finite.

2. Unit:

    A unit is an individual person in a human popultion, a card in a file of cards, etc. A population is built up of elementary units which cannot be further broken down.

3. Sampling Unit:

    A group of elements used for the purposes of selection of a sample, such as a village of inhabitants, a class of students, one hour of patient activities, etc.

4. Cluster:

    A group of elementary units, such as a cluster of persons (a household, etc.), which constitute a sampling unit.

5. Sampling Fraction:

    The fraction of the population selected for the sample. The reciprocal of the sampling fraction is known as the inflation factor.

6. Systematic Sampling:

The selection of a sample from a list, by selecting one out of the first k units, and selecting every kth unit thereafter.

7. Probability Sample:

A sample in which every sampling unit in the population has a predetermined or ascertainable probability of being selected. If no repetitions are allowed, it is a probability sample selected without replacement. If repetitions are permitted, the sample is selected with replacement.

8. Probability Proportionate to Size:

When the units appear in the sample with probabilities proportional to some measure of size of the units [ie. the number of elements in a unit].

9. Strata:

When the population is divided up into groups and a sample is selected from each group, the groups are called strata [pp. 11-12].

2.10.2 Characteristics and Advantages of Sampling Methods

Sampling is frequently-used technique for gathering information, and can be of great value "to summarize, for the guidance of administrators, facts which would otherwise be inaccessible owing to the remoteness or obscurity of the units involved or there numerousness [Raj, 1972, p.xv]". In the case of the present investigation, "the facts" consist of estimates of time spent in contact between Phase III students and medical faculty members.

Deming(1966) related six characteristics and advantages of sampling over other statistical procedures:

> (1) Usefulness and comprehensiveness of content,
> (2) Reliability of results, sufficient for the purpose,
> (3) Intellegiblity (classifications and definitions that are understood),
> (4) [Greater] speed,
> (5) [Increased] economy of operation, and
> (6) Accurate interpretation and presentation [pp. 3-4].

2.10.3 Stratification and Clustering[1]

A technique often used in sample surveys is stratification. Stratification is defined as a classification or separation of elements into a number of mutually exclusive and exhaustive sub-populations, or strata. This technique, if properly carried out, is advantageous (1) in reducing error due to sampling and consequently increasing efficiency, (2) in enabling sampling of rare events, (3) in enabling sampling by various procedures over different sub-populations, (4) in decreasing administrative effort, and (5) in enabling independent estimation at each stratum level.

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[1] The information reviewed in this section can be found in any standard text on sampling theory, such as Cochran(1966), Deming(1966), and Raj(1972).

Another frequently-used technique is clustering. Clustering is a method whereby several elements are grouped together to form a new, single sampling unit. The main purpose behind clustering is to reduce the cost of data collection.

In order to avoid subjective biases, a probability selection method is almost always desired, and, to allow "probability selection", the theory of probability is applied. Probability sampling assumes that every sampling unit in the frame has a pre-determined or ascertainable and non-zero probability of being selected. However, it does not necessarily assume equality of selection probability.

2.10.4 Sampling Errors[1]

There are three major types of uncertainties commonly found in sample surveys. Structural limitations [or the so-called Type I errors] are independent of the size or kind of sample being used. Examples of Type I errors are: (1) measurement deficiencies, inneffective coding rules, (2) ommissions of certain classes of the universe, poor timing

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[1] This section relies on basic information found in Deming(1966).

of the survey, (3) bias due to misuse of weights, and (4) unwarranted interpretations of the results, failure to report limitations of the study.

Operational [or Type II] errors are usually single, specific mistakes that occur while one is conducting a survey. Type II errors may be caused by lack of quality control or by mistakes made by interviewers.

Sampling [Type III] errors are defined as errors due to (1) selections of samples, or (2) non-systematic measurement errors. These errors are inherent, uncorrelated, non-persistent, accidental, and are of a cancelling nature. However, sampling errors are the only ones which can be partly estimated, and this may be accomplished by calculation from the sample itself, under certain conditions.

Since the sample uses a portion of the population to estimate the population characteristics, estimates based on sampling methodologies are subject to "sampling error". Yates(1965) tells us that "even if a proper process of selection is employed, the sample cannot be exactly representative of the whole aggregate... errors will depend on the size of the sample, on the variability of the material, on the sampling procedure adopted, and on the way in which the results are calculated [p.2]."

To reiterate, sample survey estimates are subject to two major classifications of errors -- sampling and non-sampling. Gonzalez (1975) states that sampling errors result from observations made only on a sample rather than the entire population. He further explains that non-sampling errors can be attributed to sources such as:

(1) the inability to obtain information from all cases in the sample

(2) the difficulties in defining terms and assumptions

(3) the variation in the interpretation of survey questions by the respondents

(4) the inability or unwillingness of respondents to provide correct information

(5) operational survey errors (ie. in the collection, editing, coding and processing of survey data)

Sampling deviation, as defined by Gonzalez, is the difference between a sample estimate and the average of all possible sample estimates. Standard error of a sample estimate is a measure of the variation among estimates from all possible samples, and is thus a measure of the precision with which an estimate from a particular sample approximates the average result of all possible samples. The relative standard error of a sample, or the coefficient of variation, is defined as the standard error of the estimate divided by the value being estimated. The standard error partially measures the effect of certain non-sampling errors as well,

but does not measure any systematic biases in the data. Bias is the difference between the sample estimate and the desired value, averaged over all possible samples.

2.11 Summary

Operations research, or the application of the scientific method to problems involving the operations of systems, has had widespread application in all facets of both private and public management. As the level of technology and the complexities of management increase, so does the need for study into the ways and means of improving efficiency and effectiveness. Quite often, operations research has proven to be an effective cost-reduction and output-maximization technique.

In the health sector, operations research has been frequently utilized in recent years, particularly in hospitals. Lately, however, its methodologies have been challenged as being too mechanistic, and neglecting such subjective measures as the quality of patient care.

Medical educators have called for an increase in system-oriented research. The costs of training physicians is on a steady increase, and standards for licensure are constantly being re-evaluated in light of new technological advancements in medical science, and the introduction of new

curricular programs.

Studies evaluating the many facets of medical education have been numerous and widespread, however manpower studies have been scarce. Courses and instructors are being evaluated on a regular basis, and a study is underway to establish a medical school information system to improve reporting, operation, and budgetary control.

Two studies have been conducted to assess the level of contact between clinical clerkship students and their supervisory staff and instructors. Results appeared useful in estimating resource distributions amongst education and patient-care, as well as in evaluating the clerkship programs themselves and relating their purpose to the overall philosophy of the Canadian medical schools.

The terminology of sampling theory was defined, and the characteristics and advantages of the various sampling methods were reviewed.

Chapter 3

METHODOLOGY

3.1 Research Strategies

As outlined in Chapter 1, the primary objective for this study was to establish an accurate estimation of Phase III faculty-student contact time and to evaluate the methodologies applied. In other words, the task was to estimate the time spent by various members of the Faculty of Medicine in direct contact with Phase III medical students.

In order to facilitate the most appropriate methodologies of data collection, several alternative modes were considered. The author was faced with three primary questions to be resolved:

(1) From whom was the data to be collected?
(2) What was to be the time frame of the data collection phase?
(3) How was the data to be collected?

3.1.1 Survey Respondents

In deciding who was to record the faculty-student contact times and report to the researchers, there were several alternatives considered. Grady et al.(1975), in their research proposal, considered four:

(1) faculty preceptors;
(2) paid observers;
(3) paid interviewers; and
(4) the students themselves.

Alternatives (1) and (2) were ruled out immediately by these authors, primarily due to previous experiences by others which showed inadequacies of the methods and overburdening expense. Alternative (3) was also rejected, due to the potential threat to and annoyance for the students and preceptors, as well as the difficulty in finding interviewers to work one hour each evening for a year. The last alternative (4) was deemed most feasible, mainly attributed to conveniences such as:

(1) the lack of need for observers or interviewers, thereby avoiding annoyance they might create,

(2) a reasonable degree of objectivity, and

(3) the reasonable cost in carrying out such a study.

In selecting alternative (4), the authors did take into account the potential disadvantages. For example, student respondents were potentially biased, reflecting more the students' point of view rather than the actual amount of contact time. In addition, the probability of non-response problems was increased, due to the students' busy schedules, and lack of incentives or motivation. However, the Grady et. al.(1975) ascertained that student respondents still constituted the most feasible alternative.

3.1.2 Time Frame of the Study

The alternatives considered by Grady et al.(1975) for the time frame were (1) a cross-sectional, one-week frame, and (2) a frame over a period of time. The cross-sectional frame, or the sampling of a population once, certainly would have been the simplest choice. However, as suggested in the ACMC Study discussed in Chapter 2, this method fails to account for variations over time, and inferences can only be made with respect to the particular time period chosen for sampling.

On the other hand, a substantially long time frame reduces levels of uncertainty, and more accurate results can thus be obtained. It must be noted, however, that a system can undergo characteristic change over such a time period, and this variation cannot be systematically identified.

Nevertheless, the one-year time frame chosen by Grady et al.(1975) was accepted because it coincided with the existing academic cycle. In addition, this frame enabled the cancelling out of variations due to seasonality, and over a year's period, the academic cycle remains relatively stable (ie. no course content alterations). In terms of resource allocation, a one-year time frame is also well-matched to the cycle of the Faculty's annual budget.

3.1.3 Data Collection Method

Grady et al.(1975) considered the question of "how the data is to be collected" and reduced it to two possibilities: by complete enumeration or by sampling. Raj(1972) points out that sampling can be as dependable a method as that of complete enumeration or census, for the following reasons:

(1) Census data is subject to serious errors due to the need for a multitude of qualified enumerators, tabulators, and supervisors, of whom there are limited quantities available.

(2) Large scale censuses are characterized by large systematic errors; sample surveys are small and more-qualified workers are available that can be adequately trained.

(3) The cost of a sample survey is usually a mere fraction of that of a census, and results can be produced considerably faster.

(4) The scope of inquiry can be broader by using

> sampling methods, due to the possibility of collecting information of a specialized type or of a more delicate nature [pp.7-8].

Although there are some limitations in the use of a sample survey, this method was chosen for the present study. The rationale for using the sample survey is discussed in greater depth later in this chapter.

To reiterate, the information obtained from the research proposal (Grady et al., 1975) led this author to select the following methodological framework: (1) a sample survey, (2) to be carried out over an extended period of time, and (3) using the Phase III students as respondents.

3.2 Sampling Design

A stratified, cluster sampling design was developed for the Phase III study. The following sections outline the details of this design.

3.2.1 Assumptions and Constraints

Like any other sampling survey, the actual design is influenced by environmental and resource constraints. The following are the major assumptions and constraints that applied to the present study.

1. Variability of Contact Time:

It was assumed that the variablilty of contact time <u>within</u> any hospital-department-rotation week unit was less than the variation of contact time amongst these units. Stratification is performed to take advangage of this assumption.

2. Sample Size:

It was postulated that too many requests would decrease the students' interest in the study, resulting in adverse effects on the response rate and quality of data. It was assumed, based on the results of the pilot study, that students could be asked to complete the instrument an average of four times each, over the 52-week time frame, without placing too much pressure on them.

3. Cyclical Homogeneity:

It was assumed that, within a one-year period, student activity is more or less similar over the same rotation-week. In other words, Rotation-week #1 of the Surgery department in September would generate activities similar to Rotation-week #1 of Surgery in May at the same hospital. This assumption also covers changes of preceptors (or other staff) within a single hospital and department during the year.

4. Homogeneity Within Cohorts:

Within a single cohort, it was assumed that the students' activities would be more or less the same for a given rotation week. This infers that at a particular hospital, in a particular department, and during a particular rotation week, all students perform relatively homogenous activities. However, activities may vary substantially over different rotation weeks.

3.2.2 <u>Design Specification</u>

The following design specifications were applied to the

Phase III study:

1. Elementary Unit:

The basic unit for this study was defined as one week of student activity [a student-week], beginning on Thursday at 9:00 A.M., and ending the following Thursday at 9:00 A.M. The reason for the selection of a student-week as the basic element was because (1) a week constitued a natural unit in the academic cycle, and (2) a week was a reasonable span of time for a student to remember his/her activities (Grady et al., 1975).

2. Study Population:

The study (or accessable) population was all Phase III student-weeks between September 4, 1975, and September 3, 1976 at the University of Alberta Faculty of Medicine. It was the intention of the author to derive possible generalizations for future years, based upon results obtained from the study population. This includes a full year of academic activities for Phase III students. Since Phase III consists of relatively equal numbers of third- and fourth-year students, the study population may be considered to represent the

activity of two years of the program for each student. At the design stage, the total number (N_T) of student-weeks was estimated by:

$$N_T = 108 \times (52 + 28) \times 2 \times 1/2$$
$$= 8640 \text{ student-weeks}$$

since:

Equation term definition:	Value
Average number of Phase III student intern positions/year	108
Formal rotation-weeks/year required for Phase III students	52
Elective-weeks/year required for Phase III students	28
Phase III (3rd and 4th) years	2
Study years per Phase III year	1/2

The basis behind the determination of population size results from the fact that a Phase III student is expected to complete his/her third and fourth years of the program over a two-year period. In light of this, the study population was estimated at <u>8640 student-weeks</u>. However, due to some uncertainty of the number of students in each

year, actual population size varied somewhat.

3. Sample Size:

The number of elements (n_T) chosen to represent the Study Population was determined by:

$$n_T = 2 \times 108 \times 4$$
$$= 864 \text{ student-weeks}$$

since:

Equation term definition:	Value
Number of Phase III years	2
Number of student intern positions/year	108
Average number of sampled weeks/student	4

Assumption 2 states that students were deemed able to complete an average of four instruments over the study period. Under this constraint, then, the total sample size was set at <u>864 student-weeks</u>, giving an overall sampling ratio [n:N] of 1:10.

4. Stratification:

The population was stratified over four levels (1) for administratative convenience, (2) judged to be natural divisions, and (3) to account for homogenous student activity. The first level of stratification was by type of internship [either formal rotation or elective]. The elective strata were further broken down into 52 calendar-weeks, with a total (N_E) of:

$$N_E = 28 \text{ X } 108 \text{ X } 2 \text{ X } 1/2$$
$$= 3024 \text{ student-weeks}$$

Therefore, the sub-population of the elective stratum came to a total of <u>3024</u> <u>student-weeks</u>.

The formal rotation stratum consisted of a total (N_R) of:

$$N_R = 52 \text{ X } 108 \text{ X } 2 \text{ X } 1/2$$
$$= 5616 \text{ student-weeks}$$

The total population size of the rotation stratum was <u>5616 student-weeks</u>.

The formal rotation stratum was further broken down by hospital, by department, and by rotation-week.

By utilizing a stratification scheme, the author attempted to isolate systematic differences in responses characteristic to each particular stratum, and subsequently minimize standard error. The stratification scheme is diagramatically represented in Figure 1.

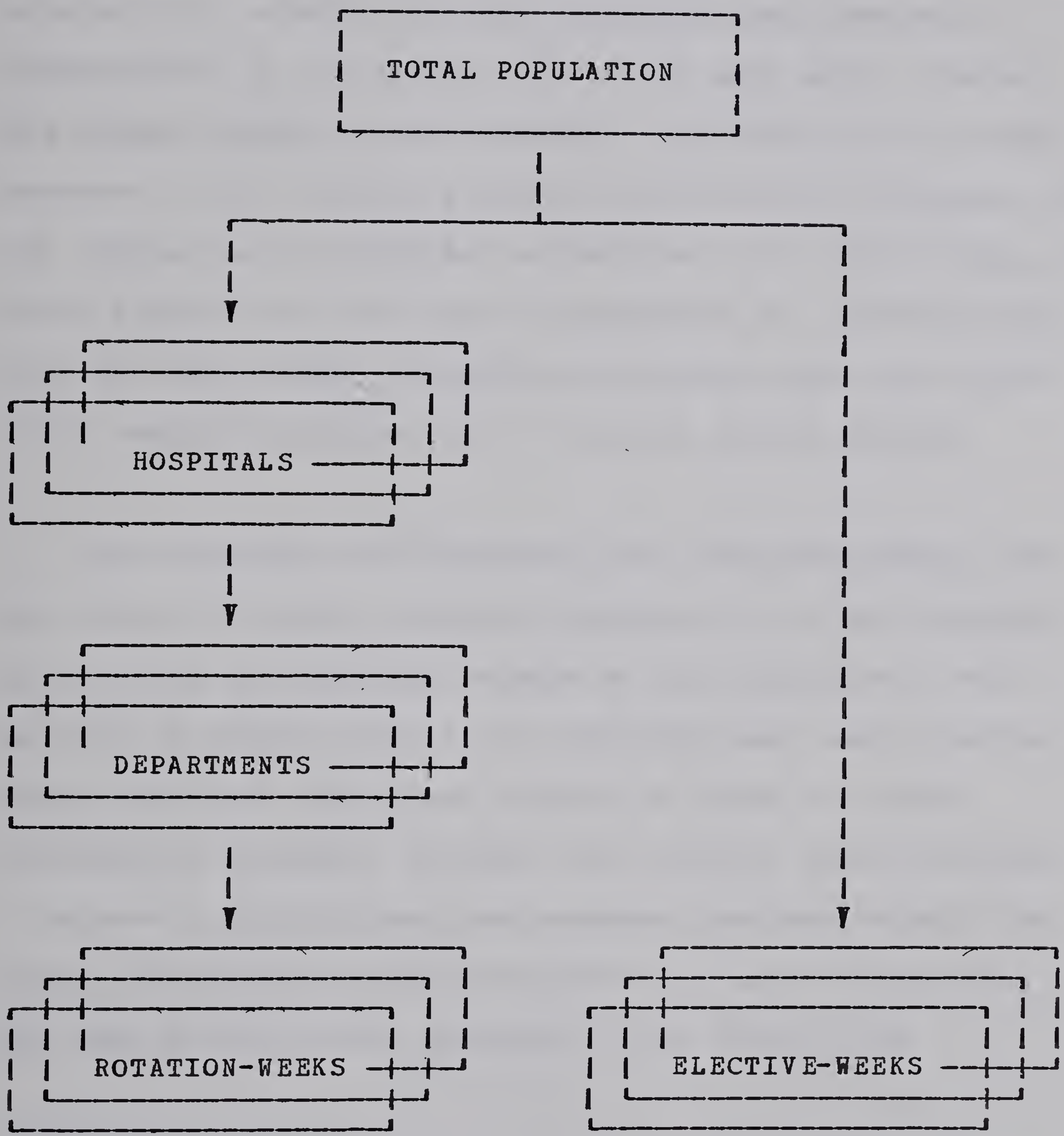
In summary then, the sampling design was both cross-sectional and longitudinal, and was time-dependent, accounting for changes of the system over the 52-week time frame. A multi-level stratification scheme was also developed to minimize overall standard error.

3.3 Sample Allocation and Selection

Allocating a sample to the various strata can be handled in various ways (Raj, 1972, p. 51). One method, known as the "proportional allocation technique", dictates that the sample size in a stratum is proportional to the total number of units in that stratum. For an optitmum

Figure 1

LEVELS OF STRATIFICATION



allocation, the Neyman Allocation Formula (Raj, 1972, p.51) indicates that the number of units in the sample from a stratum should be proportional to the product of the stratum size and the stratum standard deviation, and inversely proportional to the square root of the unit cost. However, the Neyman formula is not directly applicable to this study because (1) the stratum standard deviations are unknown, and (2) because of the need for a breakdown into small strata. A third method, that of "equal allocation", is conducted such that the same number of units are selected from each final stage stratum irrespective of the size of the stratum.

In selecting and allocating the stratified sample for the Phase III study, an equal allocation rule was employed. This method was selected because of its simplicity, and because of of the facility of utilizing many small strata, each containing sufficient numbers of units to enable statistical analysis. Although the original design included a three-way replication, non-response problems reduced the number of elements in each stratum to a level prohibiting the use of statistical analysis.[1] As a result, the

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[1] The problem of non-response was not identified until the data collection phase of the study was well underway. Therefore, although the sampling was carried out as if a three-way replication was in force, the data was ultimately aggregated to eliminate the replication factor. This is discussed in more detail in Chapter 4.1.

replication factor was ultimately discarded from the study.

Because the methods of selection differed for formal rotation and elective strata, they are discussed separately.

3.3.1 Formal Rotation Selection

The formal rotation stratum was broken down by hospital, by department, and by rotation week, and was selected in the following manner.

For each of the 25 hospital-department combinations available to Phase III students (see Table I), a chart was prepared in a similar format to that illustrated in Figure 2. This particular example chart was used to select students from the Medicine (Part 1) department at the Royal Alexandra Hospital.

In this example, the rotation was of eight weeks duration (rotation weeks are listed down the left-hand column), and six consecutive rotations (or cohorts) were sampled over the one-year study time frame, giving a total of 48 calendar weeks (Calendar week #17 was eliminated because of the Christmas vacation; therefore, a total of 49 calendar weeks actually appear on the chart). For each hospital-department group analyzed in this manner, the number of cohorts was pre-determined, based on schedules

FIGURE 2

HOSPITAL RAH DEPT. MED 1

AVERAGE # 0 6 RATIO 3:6 STRATUM SIZE 2 4

CALENDER WEEK	01/08	09/17	18/25	26/33	34/41	42/49			REPLICATION RANDOM NUMBER		
ROT. WK. \ COHORT	1	2	3	4	5	6		TOTAL	A	B	C
1	1^A	9	18	26^B	34	42^C		3	1	4	6
2	2	10^C	19^B	27^A	35	43		3	4	3	2
3	3	11^A	20^C	28	36	44^B		3	2	6	3
4	4^A	12^B	21^C	29	37	45		3	1	2	3
5	5	13^A	22	30	38^C	46^B		3	2	6	5
6	6^A	14	23	31	39^C	47^B		3	1	6	5
7	7	15^C	24^B	32	40	48^A		3	5	3	2
8	8	16^C	25^B	33	41	49^A		3	6	3	2
SAMPLE SIZE	3	6	5	2	2	6		24			
TOTAL NO. OF STUDENTS	06	06	06	06	06	05		35			
RANDOM NUMBERS FOR STUDENT SELECTION	6 2 1	6 3 4 1 5 2	5 2 4 3 6	3 5	2 5	5 2 5 1 4 3					

STRATUM	STRATUM POPULATION	STRATUM SAMPLE SIZE
RAH-MED 1 - RW 1	35	3
RW 2	35	3
RW 3	35	3
RW 4	35	3
RW 5	35	3
RW 6	35	3
RW 7	35	3
RW 8	35	3
TOTAL FOR 8 STRATA	280	24

provided by the Office of the Dean of Medicine, by the number of times the duration of the rotation (12 weeks rotation for Surgery, 8 for the rest) could be divided evenly into the 52 weeks of the study time frame.

The first stage of selection involved the selection of three cohorts from each of the eight rotation weeks. These cohorts of student weeks were known as clusters of sampling elements. The above selection was done by simple random sampling, without replacement. The three selected cohorts for Rotation Week #1 in the example chart, were Cohorts 1, 4, and 6 respectively (A). The appropriate columns were then marked with the assigned replication number (B).

The next stage in the process consisted of the selection of student-weeks from each of the previously-selected cohorts. In the example, Rotation Weeks 1, 4, and 6 had already been selected from Cohort #1 by the first-stage selection process, giving a sample size of three student-weeks (C). It was also known in advance that six students were registered for the first 8-week rotation (D). Therefore, by simple random sampling without replacement, three student-weeks were selected from a possible six, with equal selection probability (E). When the sample size exceeded the number of registered students, as it did in Cohort #6, repetitions were permitted.

The number of students registered in each rotation was obtained from lists of the students' names, made available to the author by the Faculty of Medicine. The students' names appeared on the lists in random sequence. The final selection of student weeks was made by applying the random numbers obtained in (E) to the randomly-ordered lists of students. For example, the illustration chart in Figure 3.2 shows random numbers of 6, 2, and 1 selected for Cohort #1. This means that if John Smith was the sixth name on the list, he would be selected to respond during Rotation Week #1 and Calendar Week #1. Similarly, the person whose name appeared second on the list would be a respondent during Rotation Week #4 and Calendar Week #4. This procedure was carried out for the entire chart, and it can be shown that the third person on the sixth rotation list was chosen to respond during Rotation Week #8, Calendar Week #49 (F).

3.3.2 Elective Selection

The elective student-weeks were stratified into fifty-two calendar-week groups. Students assigned to electives were selected by a special systematic random sampling technique. To illustrate, lists of students were obtained every three months showing the electives to which each student was assigned. The list was ordered so that the students' names appeared in the order of the commencement date of their chosen electives. Student-weeks were then

selected randomly [and with equal probability] from the list with a selection ratio of 1:10. Each of the selected student-weeks was sequentially assigned a replication number [A, B, or C], giving an overall selection ratio of 1:30 (one-tenth X one-third).

3.4 Assignment of Weights

Due to the unequal stratum population sizes, and subsequent unequal probabilities of selection, an assignment of weights was necessary to adjust the results in order to achieve the representation of the various strata in the total population; that is, to provide unbiased estimates.

This can be shown in the following manner. Assuming that the probability of selecting a sampling element i (with measurement value Yi) is given by Pi, and assigning the subject's weight Wi, then the weighted element Zi is defined as the product of Wi and Yi. The total population estimate ($\hat{\zeta}y$) can then be expressed as $\hat{\zeta}y = \Sigma Zi = n\bar{Z}$, where n is the total sample size and $\bar{Z}$ is the sample mean of weighted values. The mean estimate ($\hat{\mu}y$) can be related to population size N by $\hat{\mu}y = \hat{\zeta}y/N$ and also $\hat{\mu}y = n\bar{Z}/N$. If Wi is inversely proportional to the selection probability Pi, it can be shown that $E(\hat{\zeta}y) = \zeta y$ and $E(\hat{\mu}y) = \mu y$, where E denotes statistical expectation (Raj, 1972). The above equalities of expected values with population values signify unbiased

estimates.

The requirement for unbiased estimation is that the weight must be inversely proportional to the selection probability, namely:

$$W_i \propto 1/P_i$$

If equal probabilities are used for a stratum h, then the selection probabilities and weights are common to all units selected from the stratum, namely $P_h = n_h/N_h$, and $W_h \propto N_h/n_h$. By taking a constant of proportionality equal to one, then:

$$W_h = N_h/n_h$$

where: W_h = the assigned weight for Stratum h
n_h = sample size of Stratum h
N_h = stratum population size.

However, this formula assumes perfect response rate, and as noted earlier, the rate of response achieved by the study was relatively poor. This being consistent with most studies relying on the mail questionnaire method, a second weighting factor was applied to the above expression to account for missing data [non-response] within each stratum. Underlying

this adjustment is the assumption that, within each stratum, the non-respondents carried out more or less the same activity as the respondents.

Therefore, if:

m_h = the # of valid samples in Stratum h

then,

$W_h = N_h / n_h \times n_h / m_h$, or

$$W_h = N_h / m_h$$

In calculating the weights for the Phase III study sample, the author employed the following procedures:

(1) Calculation of W1 [equal to N_h / n_h]:

For each of the formal rotation strata, the population size [N_h student-weeks] was calculated by multiplying the number of cohorts in the stratum by the number of students participating in the rotation. The stratum sample size [n] always had the value three [the number of selected cohorts per stratum] because of the equal allocation. Therefore, the value of W1 for each stratum [h] was given by:

$$W1_h = \text{\# of student weeks} / 3$$

Because the elective sample was selected systematically with a sampling ratio of 1:10, the W1 weight was held constant across all elective strata and given a value:

$$W1_h = 10 / 1$$

(2) <u>Calculation of W2 [equal to n_h/m_h]</u>:

Due to the low response rate, the author was faced with the problem of "empty-cells", whereby the number of responses in a particular stratum [m_h] equalled zero. In this situation, a weight [W2] could not be calculated, as the expression [n_h/m_h] had a zero-denominator. Because of this problem, the fifty-two elective strata had to be regrouped into thirteen four-week strata, for weighting purposes.

Once all regroupings were completed, W2 was derived for each of the twenty-five formal rotation and thirteen elective strata [h] by:

$$W2_h = n_h / m_h$$

The weights were then applied to the various variables

using the "WEIGHT" facility of the "Statistical package for the social sciences (SPSS)" (Nie, 1970).

Tables I and II present a summary of weights applied to the study sample. For example, the total stratum weight for rotations at the Royal Alexandra Hospital, department of Obstetrics, was 17.5. In addition, the first of the elective strata was assigned a weight of 39.0.

3.5 Research Instruments and Selection Procedures

The primary instrument consisted of a time sheet [see Appendix B]. Every selected student was asked to complete a time sheet over the weekly time-period assigned to him/her [a student-week]. The time sheet questions required responses relating to attributes for every activity engaging the student's time during that week. The attributes were: (1) activity type, (2) the number of preceptors, residents, interns and other Phase III students present during the activity, (3) the duration of direct contact between the student and those listed above, and (4) an estimate of the proportion of direct instruction perceived by the student during the activity. When the number of faculty changed during the course of an activity, students were requested to give an average of the number, rounded upwards.

At the time of preparing the sampling design, exact

Table I

Summary for Rotation Samples

HOSPITAL	DEPARTMENT	N_h*	n_h *	m_h *	$W1_h$ *	$W2_h$ *	W_h *
University	Med I	392	24	10	16.3	2.4	39.1
	Med I(b)	192	24	9	8.0	2.7	21.6
	Med II	192	24	11	8.0	2.2	17.6
	Med II(b)	232	24	10	9.7	2.4	23.3
	Obstetrics	360	24	13	15.0	1.8	27.0
	Pediatrics	208	24	20	8.7	1.2	10.4
	Psychiatry	288	24	9	12.0	2.7	32.4
	Surgery	504	36	11	14.0	3.3	46.2
Royal Alex	Med I	280	24	10	11.7	2.4	28.1
	Obstetrics	232	24	13	9.7	1.8	17.5
	Pediatrics	212	24	11	8.8	2.2	19.4
	Psychiatry	144	24	9	6.0	2.7	16.2
	Surgery	352	36	18	9.8	2.0	19.6
General	Med II	240	24	9	10.0	2.7	27.0
	Obstetrics	120	24	9	5.0	2.7	13.5
	Psychiatry	152	24	17	6.3	1.4	8.8
	Surgery	192	36	11	5.3	3.3	17.5
Misericordia	Med II	184	24	13	7.7	1.8	13.9
	Pediatrics	192	24	7	8.0	3.4	27.2
	Psychiatry	96	24	12	4.0	2.0	8.0
	Surgery	192	36	18	5.3	2.0	10.6
Camsell	Obstetrics	96	24	13	4.0	1.9	7.2
	Pediatrics	184	24	12	7.7	2.0	15.4
	Surgery	192	36	18	5.3	2.0	10.6
Alta. Hosp.	Psychiatry	96	24	8	4.0	3.0	12.0
TOTAL		5524	660	30			

*NOTE: N_h - Population Size

n_h - Allocated Sample Size

m_h - Number of Useable Responses

$W1_h$ - Stratum Weight [N/n]

$W2_h$ - Non-Response Weight [n/m]

W_h - Total Stratum Weight [W1 * W2]

Table II

Summary for Elective Samples

Stratum Time Period	N_h*	n_h*	m_h*	$W1_h$*	$W2_h$*	W_h*
Sept. 4 - Oct. 1	312	16	8	19.5	2.0	39.0
Oct. 2 - Oct. 29	234	12	6	19.5	2.0	39.0
Oct. 30 - Nov. 26	565	29	15	19.5	1.9	37.7
Nov. 27 - Dec. 24	488	25	10	19.5	2.5	48.8
Dec. 25 - Jan. 21	332	17	10	19.5	1.7	33.2
Jan. 22 - Feb. 18	429	22	14	19.5	1.6	30.6
Feb. 19 - Mar. 17	273	14	4	19.5	3.5	68.3
Mar. 18 - Apr. 14	156	8	2	19.5	4.0	78.0
Apr. 15 - Jun. 9	77	4	1	19.3	4.0	77.2
Jun. 10 - Jul. 7	20	1	1	20.0	1.0	20.0
Jul. 8 - Aug. 4	117	6	4	19.5	1.7	32.6
Aug. 5 - Sept. 1	59	3	1	19.7	3.0	59.1
TOTAL	3024	157	76			

*NOTE:
N_h - Population Size
n_h - Allocated Sample Size
m_h - Number of Useable Responses
$W1_h$ - Stratum Weight [N/n]
$W2_h$ - Non-Response Weight [n/m]
W_h - Total Stratum Weight [W1 * W2]

student scheduling was unknown, and the author used the 1974/1975 schedule for design purposes. Approximately three months in advance of student selection, the finalized rotation and elective schedules of students' names were made available to the study investigators by the Dean's Office. Immediately upon receipt of these schedules, sampling procedures were carried out, according to the specifications outlined in Section 3.3, for the three-month period directly following. This "block-type" format was used to ensure up-to-date student allocations to rotations and electives within the various hospitals and departments.

On the Monday of every week, time sheets were prepared for the student-weeks selected, corresponding to the calendar-week immediately following, and "packages" were assembled and mailed to the students the following Thursday. The lag-time between the mailing of the time sheets and the commencement of the appropriate calendar-week was set at seven days. This was done to (1) assure that the package arrived at the student's residence before the start of the current calendar-week, and (2) to assure that the package did not arrive too early, reducing the possibility of the student forgetting to complete it.

Returned time sheets were logged-in on two lists: one indexed by calendar-week, and the other indexed by identification number. This procedure allowed for on-going

"response-rates" to be observed by the author at a glance.

Two other auxilliary instruments were utilized in collecting "follow-up" information. Interviews were conducted with the preceptors of each hospital department participating in the Phase III program, for the purpose of ascertaining the shortcomings, if any, of the rotation or elective programs. The other instrument took the form of a follow-up questionnaire, and was sent to all the Phase III students who had ever received a time sheet and were still enrolled in the Faculty. This questionnaire provided the investigators with the students' comments and criticisms pertaining to the content and procedure used in the study data-collection phase.

3.6 Estimation of Margin of Errors: Standard Error

Confidence intervals may be constructed given a sample estimate and an estimate of standard error. For a given sampling rate, and for a prescribed level of confidence, the confidence interval includes the average result of all possible samples. As an example, consider the case where all possible samples are selected, and from each of which calculations of estimates and estimated standard error are made. It can be said, then, that 19 out of every 20 intervals from approximately two standard errors below the estimate to approximately two standard errors above the

estimate contains the average value of all possible samples. This is known as a 95% confidence interval.

The variance of a simple random sample without replacement in each stratum can be expressed as:

$$\mathrm{VAR}(\hat{\zeta y}) \hat{=} \Sigma n_h (1-f_h) s_h^2$$

where:

n_h = the sample size of stratum h, f_h = the sampling fraction of stratum h, and s_h^2 = the sample variance of weighted attributes in stratum h.

The estimated standard error can be expressed as the square root of the sample variance.

3.7 Summary

A stratified, cluster sample was selected, with a sampling ratio of ten percent. The sampling elements [student-weeks] were divided into two categories, namely formal rotations and electives, and each category was further sub-divided into meaningful strata.

Student-weeks for rotations were stratified by hospital, by department, and by rotation week, and selections were carried out using a crossed,two-stage simple random sampling method. The sample was equally allocated to each stratum, and two levels of weights were applied to balance out stratum population disproportions as well as

variations in response rates amongst strata.

Student-weeks for electives were selected by a systematic random sampling technique, and after stratifying with respect to calendar-weeks. Weights were also applied to account for the selection ratio and the non-response within each stratum.

In addition, the concept and possible use of standard error was reviewed in this chapter.

Chapter 4

ANALYSIS AND RESULTS

This chapter reports the study procedures and results obtained according to the specifications, assumptions and constraints outlined in Chapter 3.

4.1 Data Collection

For each selected student-week, a time sheet, accompanied by a cover letter signed by the Dean of Medicine (see Appendix B), was forwarded to the student one week in advance of his/her designated reporting interval. This procedure was followed to ensure that the student remembered to complete the instrument in the following week's period.

The data collected from the time-sheets underwent several phases of editing and tabulation before any meaningful information was extracted. The first step was the coding and the keypunching of the responses onto a machine-readable medium; namely, the computer punched-card. Each card contained a record of a single contact activity as perceived by an individual Phase III student, and was composed of fields containing data representing the

following twelve attributes:

(1) Designation (Rotation or Elective)
(2) Student Identification Number
(3) Card Identification Number
(4) Day of the Week
(5) Contact Activity Identification
(6) Number of Preceptors Present
(7) Number of Residents Present
(8) Number of Rotating Interns Present
(9) Number of Phase III Students Present
(10) Hours of Contact
(11) Minutes of Contact
(12) Estimate of Instructional Component expressed as a Percentage

Out of 817 selected student-weeks and 417 subsequent responses, a total of 378 [46%] useable returns were obtained, producing 5313 useable activity-records. This gave an average of 14 activities reported for every student-week. The activity records were edited in order to identify gross coding and keypunching errors.

As noted earlier, because of a rather substantial non-response rate, it was necessary to aggregate neighboring strata in order to eliminate those with no (or little) response. This procedure was necessary to enable computation of stratum weights. Consequently, rotation weeks were regrouped into two classifications: "first-half" (Rotation weeks 1 to 4 [1 to 6 for Surgery]), and "second-half" (Rotation weeks 5 to 8 [6 to 12 for Surgery]). Similarly, elective weeks were regrouped into thirteen four-week strata.

Contact time was then converted to units of hours, and represented in decimal notation. Preceptor-hours, resident-hours, and intern-hours were calculated for each activity by multiplying the contact time by the number of preceptors, residents, and/or interns respectively, and dividing the product by the number of Phase III students in attendance. This accounted for the share of students recording the activities. Instructional contact time was derived from the product of contact time and the percent instructional component.

Student-hours resulted from the multiplication of contact time by the number of Phase III students attending the activity. This measure was later converted to student-hours per student-week for the purpose of more meaningful comparison to measures obtained for other faculties of the University of Alberta (Institutional Research and Planning, 1970).

All measurements were weighted according to the aforementioned specifications. Consequently, the resulting values represented the unbiased estimates over all Phase III student-weeks during the study year.

With this framework in mind, two modes of analysis were employed. In the first case, faculty-hours were examined from the faculty utilization standpoint. The "faculty" was

limited to preceptors, residents and rotating interns, and Rotation-hours were analyzed with respect to hospital, department, and contact activity. Elective-hours were tabulated only by contact activity, as information on hospitals and departments for electives was not obtained.

The second approach, that of student-hours per student-week, was derived from the standpoint of the time spent by the Phase III students with various members of the teaching staff. Student-hours were analyzed in a similar manner to that of Faculty-hours.

4.2 Faculty Contact-Time

The contact that members of the Faculty of Medicine, namely preceptors, residents, and rotating interns, had with the Phase III students during rotation and elective activities, was expressed in units of Preceptor-hours, Resident-hours, and Intern-hours respectively. All measurements were estimated with respect to a one-year time period, or in terms of a one-year operation of the Phase III program.

4.2.1 Preceptor Contact Time

Each rotation or elective activity had at least one preceptor responsible for the student interns, although not

necessarily present at every activity. A Preceptor-hour was defined as one hour of contact between a single preceptor and the Phase III student(s) participating on his/her service. For example, two preceptors directly supervising one Phase III student for one hour produced two Preceptor-hours, while one preceptor supervising three Phase III students for one hour was regarded only as one Preceptor-hour.

Table IV (Appendix A) shows a breakdown of Preceptors-hours with respect to the hospital in which rotations were scheduled. Electives were grouped together and treated as though they were conducted at a single location.

The third column of Table IV represents the percentage of Preceptor-hours spent at the six hospitals under study, as well as the percentage spent in rotations and electives.

"Instructional-hours" (Column 4) were estimated by applying the "Percent Instructional Component" (re-calculated as "Proportion of Instruction") to the "Contact Hours" figures. The reader must keep in mind that this is not an objective measure of direct time, but a subjective estimation as perceived by the students. Obviously, some students may overestimate and some may underestimate, but the measurement errors are assumed to be of a cancelling nature, and in the process of aggregation, it was expected

that the estimation provided an unbiased estimator.[1]

To illustrate how to interpret Table IV, consider the case of the University Hospital. The estimated amount of instructional preceptor contact with Phase III students during rotations at this hospital was 15,077 hours over a period of one year. Dividing by 52 weeks, this can be expressed as 290 Preceptor-hours per week. If we assume that there exist, say, twenty preceptors supervising Phase III students at the University Hospital at any given time, the average contact time then becomes 14.5 hours per preceptor per week.

This may be illustrated in yet another manner. Assuming that, in any given faculty, a professor lectures and consults with his students for eighteen hours each week, over forty-eight weeks per year, and in applying these

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[1] The estimation of instructional component was examined in a separate study entitled "Scaling Techniques and Subjective Evaluation: Two Measures Estimating the Instructional Utility of the Phase III Program of Medical Education", by Nusbaum, M. [unpublished paper for course HSA531, University of Alberta, May 1976]. The study can be found in its entirety in Appendix C.

The study indicated that, inferentially, there was a degree of reliability between the responses using the two independent measures, and that Phase III students who reacted positively to the instruments were, at the least, consistant in their responses. [p.26]

figures to preceptor contact at the Edmonton General Hospital, it can be shown that the instruction provided by the hospital is equivalent to about nine full-time faculty-members [7,732/(18 X 48) = 8.9].

The reader should note that Preceptor-hours for electives make up approximately 43% of the total, although less than [3024 / (3024 + 5534)] = 36% of the total number of student-weeks were originally assigned for electives. This is probably attributed to the higher attention paid by preceptors to the students taking electives as a result of the more individualized program.

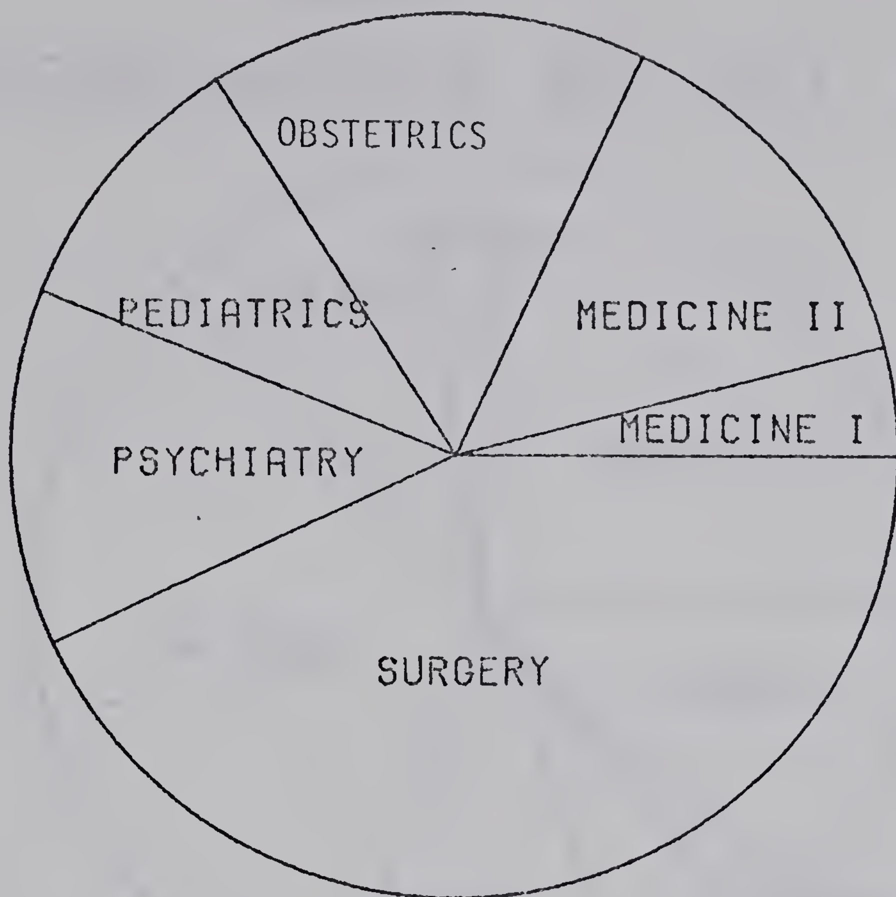
Table V similarly shows a breakdown of Preceptor-hours by departments. Note that only rotations are included in this table due to the previously-mentioned impracticality of collecting departmental information for electives. In addition, values are tabulated <u>over all hospitals</u>: further breakdown was aborted for fear of losing data reliability due to insufficient sample size.

Preceptor-hours for both rotations and electives are tabulated by Contact Activity in Table VI.

Figures 3 and 4 diagramatically reiterate the information found in Tables IV, V, and VI.

FIGURE 3

PRECEPTOR-HOURS BY DEPT.



PRECEPTOR-HOURS BY HOSPITAL

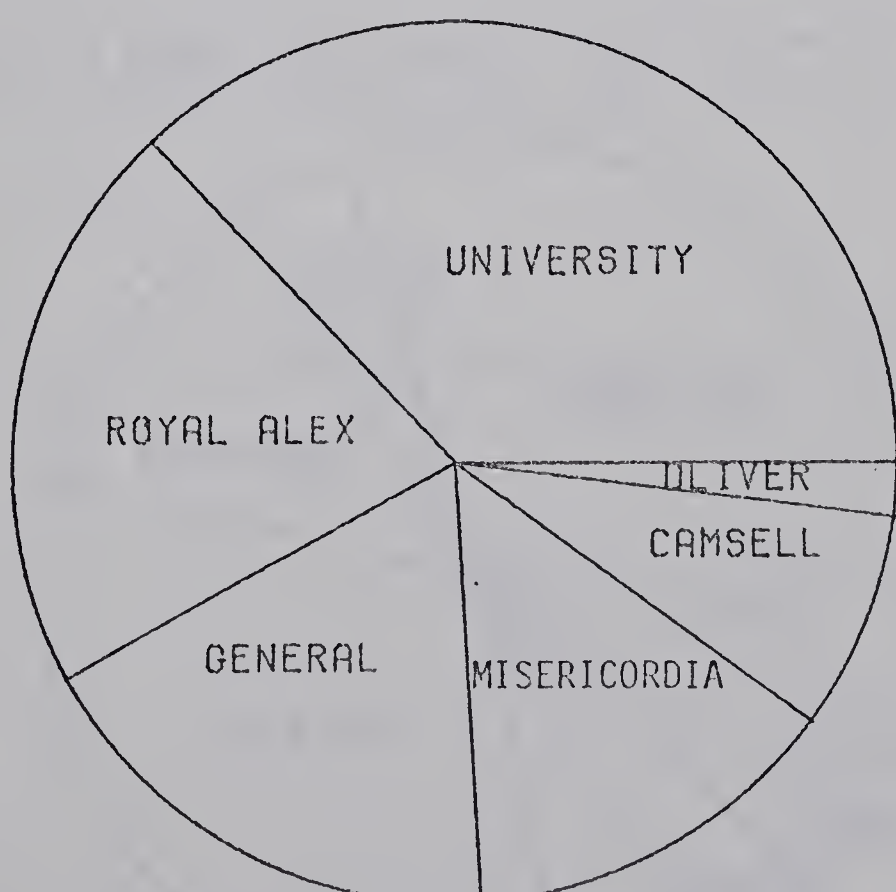
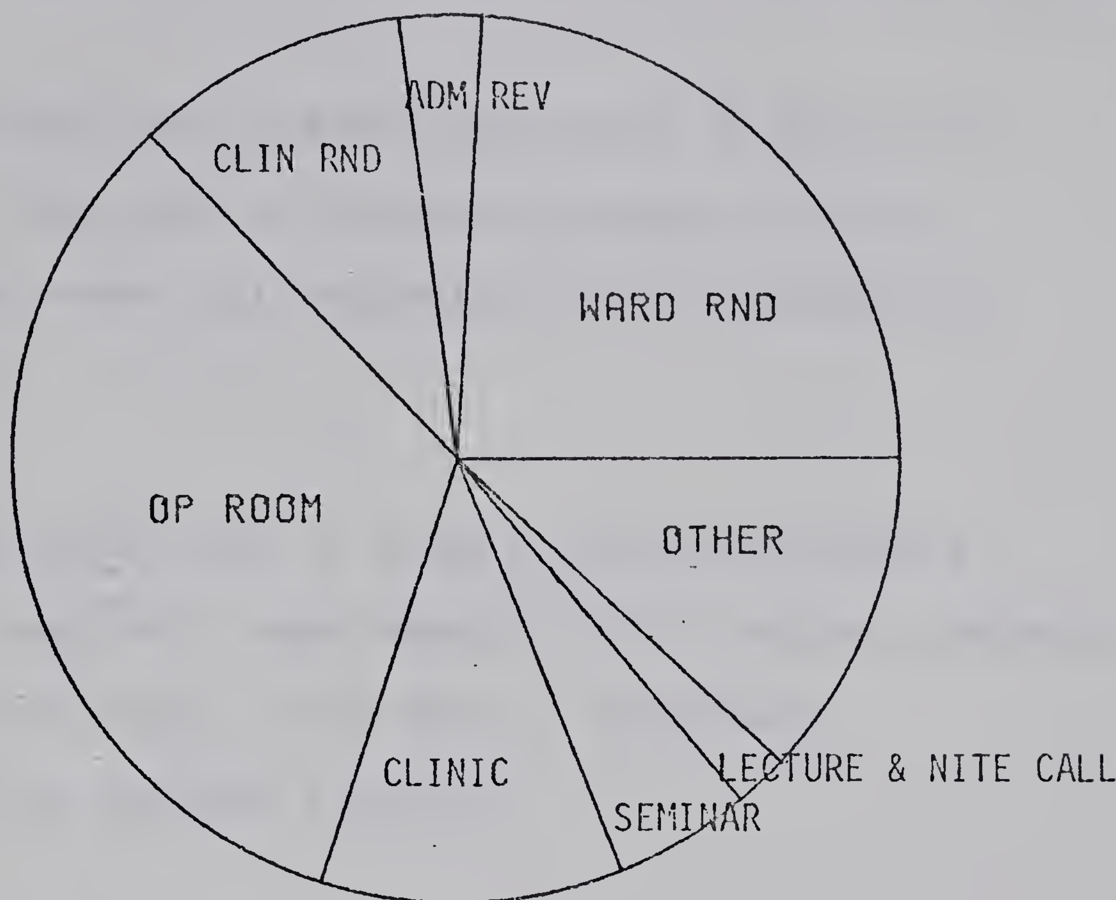
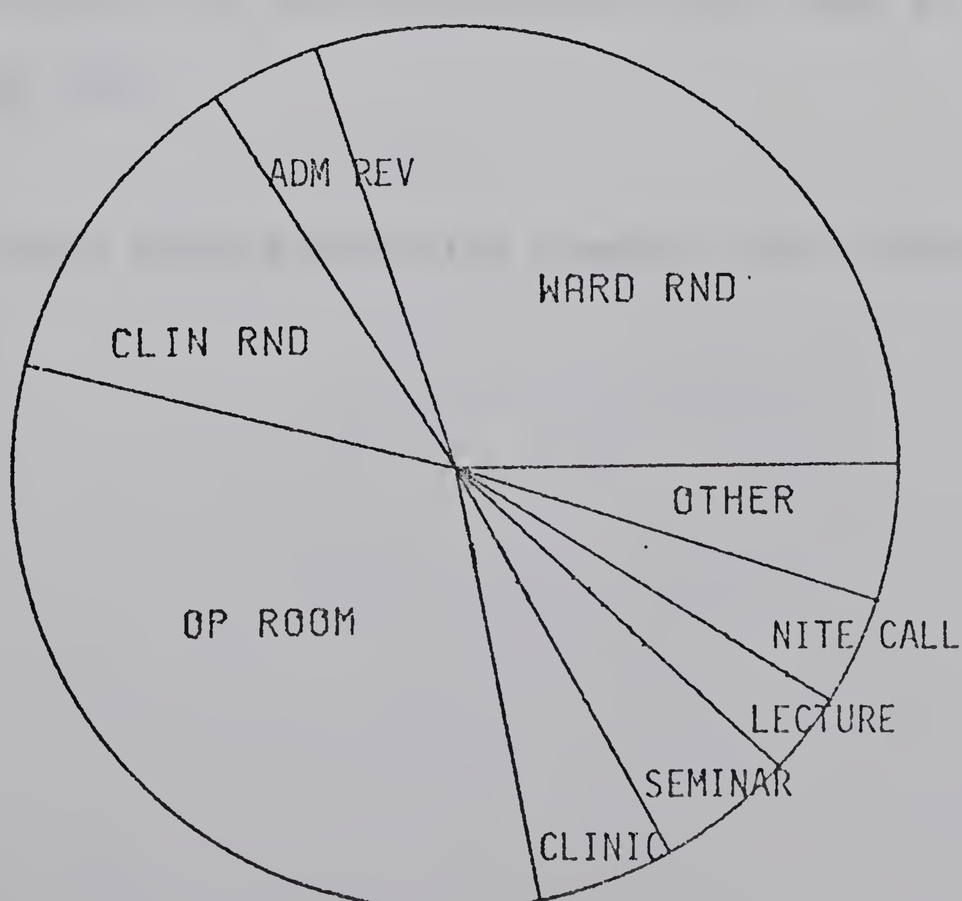


FIGURE 4

PRECEPTOR-HOURS BY ACT (ELEC)



PRECEPTOR-HOURS BY ACT (ROT)



4.2.2 Resident Contact Time and Rotating Intern Contact Time

A Resident-hour was defined similarly to that of a Preceptor-hour: one hour of contact between a single resident and the Phase III student(s) participating on his/her service.

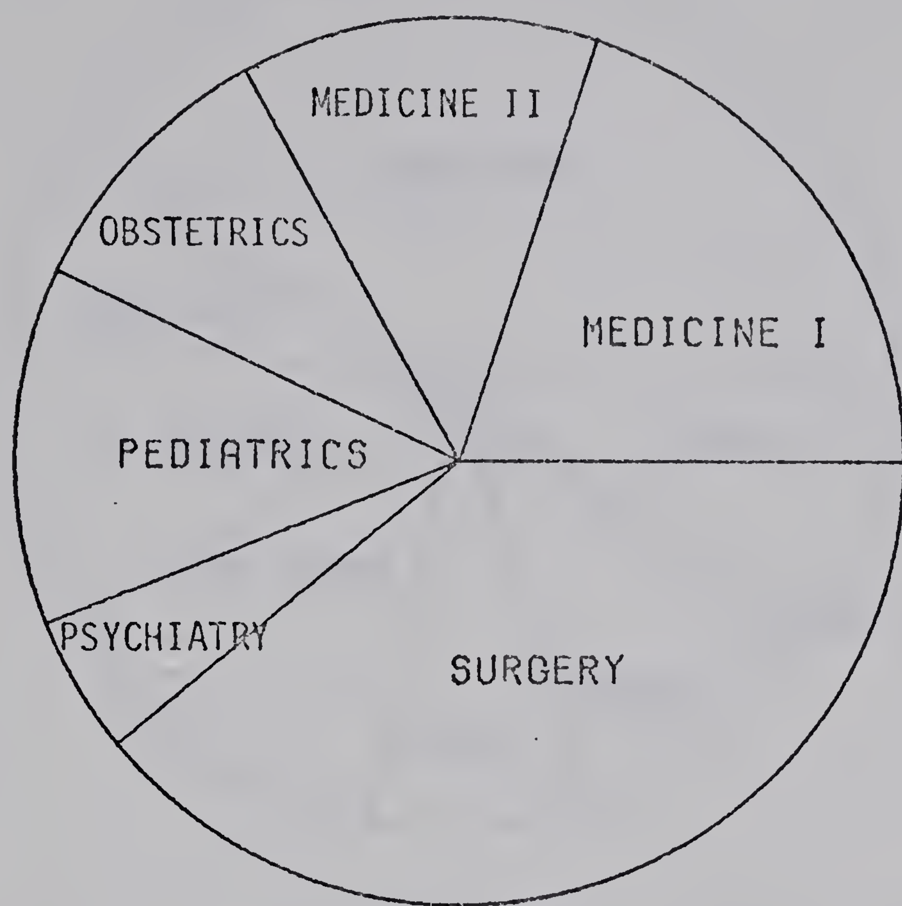
Tables VII, VIII, and IX display Resident-Contact broken down by hospital, department, and by contact activity respectively. Once again, this data is available diagramatically in Figures 5 and 6.

An Intern-hour, or one hour of contact between a single rotating intern and the Phase III student(s) participating under his supervision, is the measurement unit used in Tables X, XI, and XII.

Figures 7 and 8 diagramatically present the tabular data.

FIGURE 5

RESIDENT-HOURS BY DEPT.



RESIDENT-HOURS BY HOSPITAL

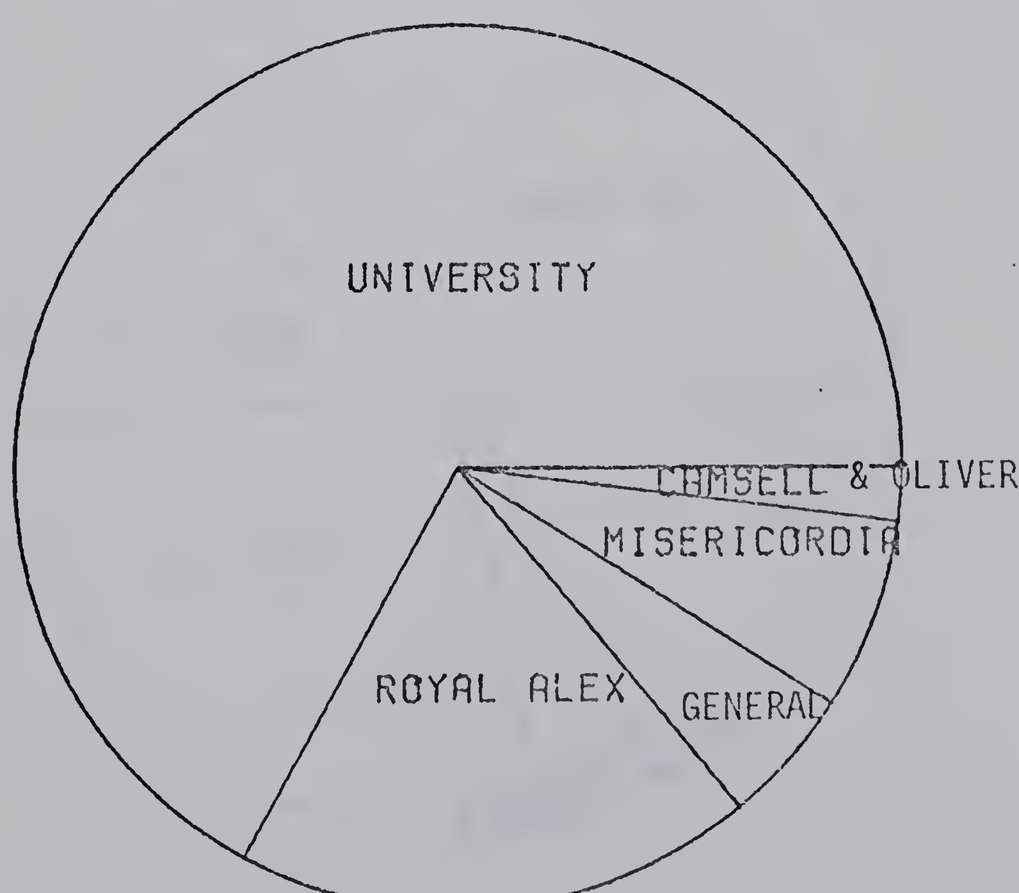
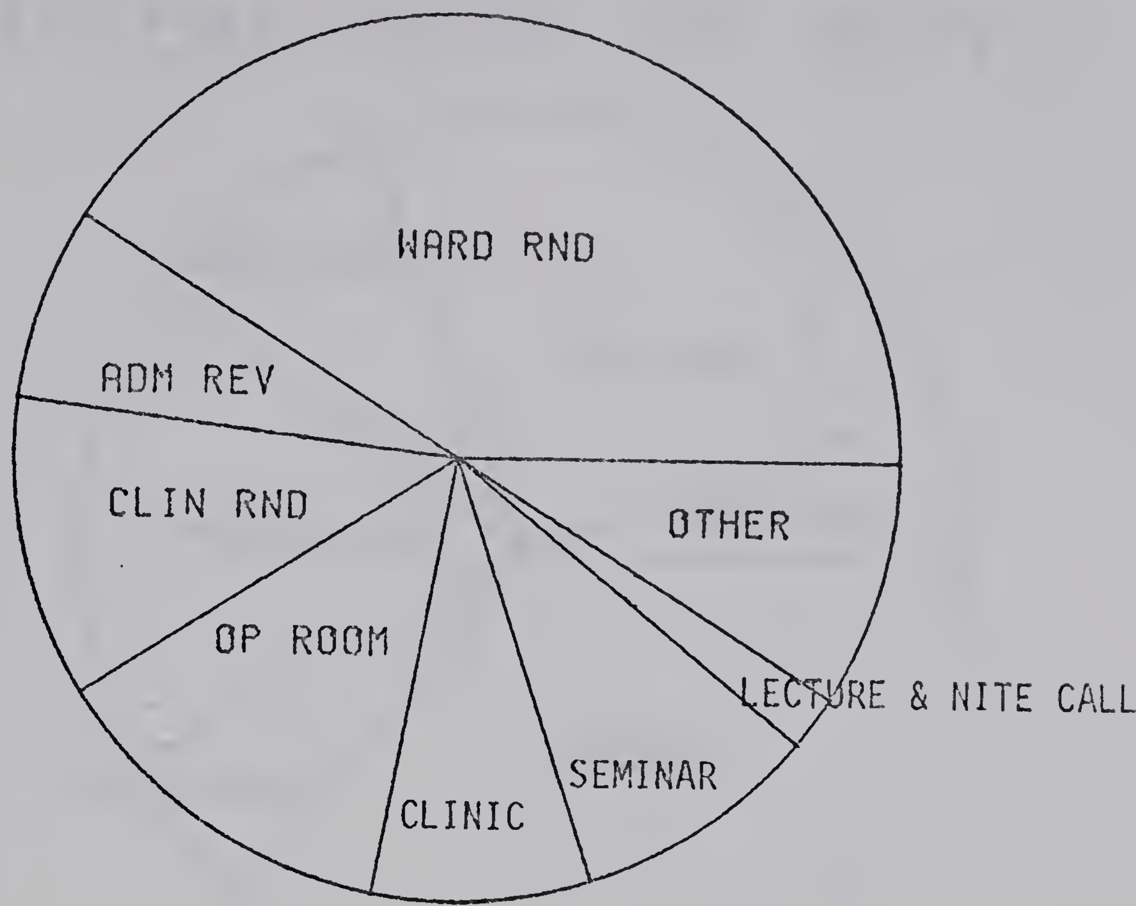


FIGURE 6

RESIDENT-HOURS BY ACT (ELEC)



RESIDENT-HOURS BY ACT (ROT)

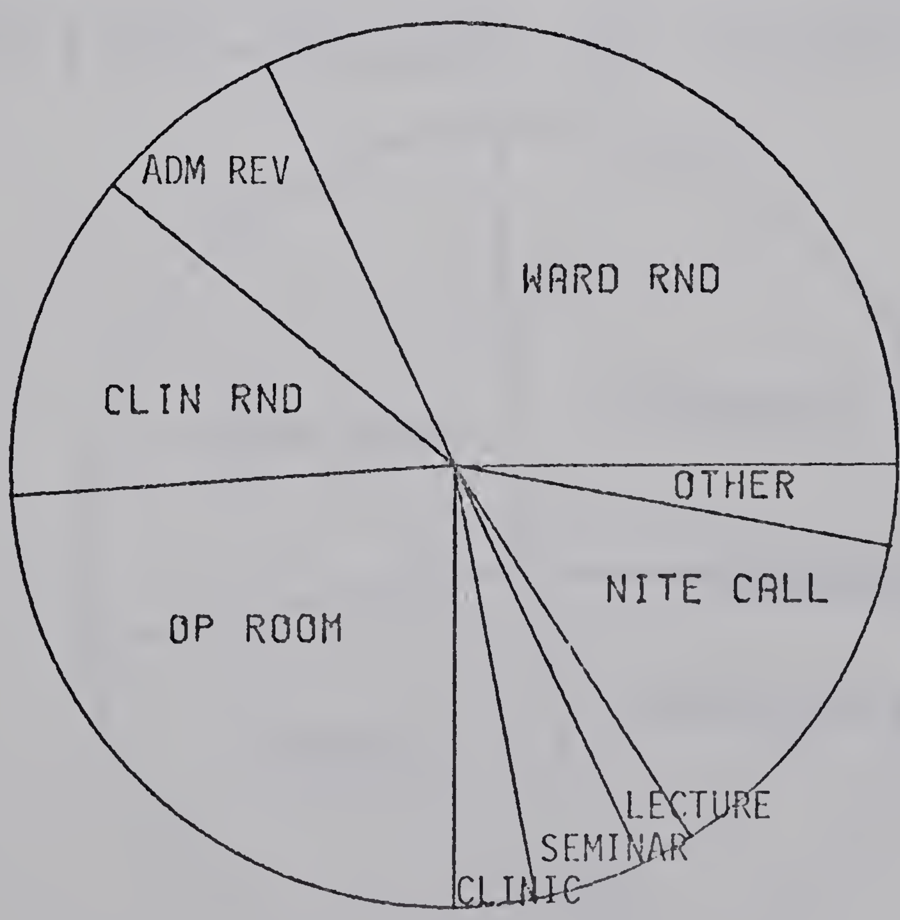
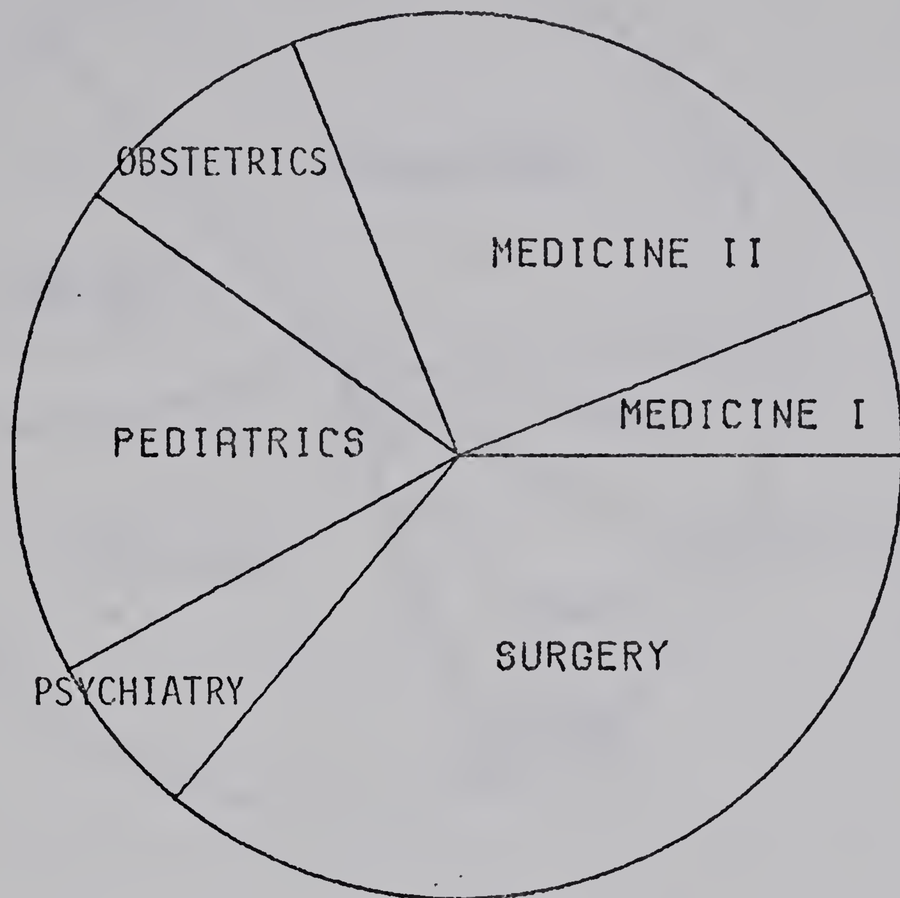


FIGURE 7

INTERN-HOURS BY DEPT.



INTERN-HOURS BY HOSPITAL

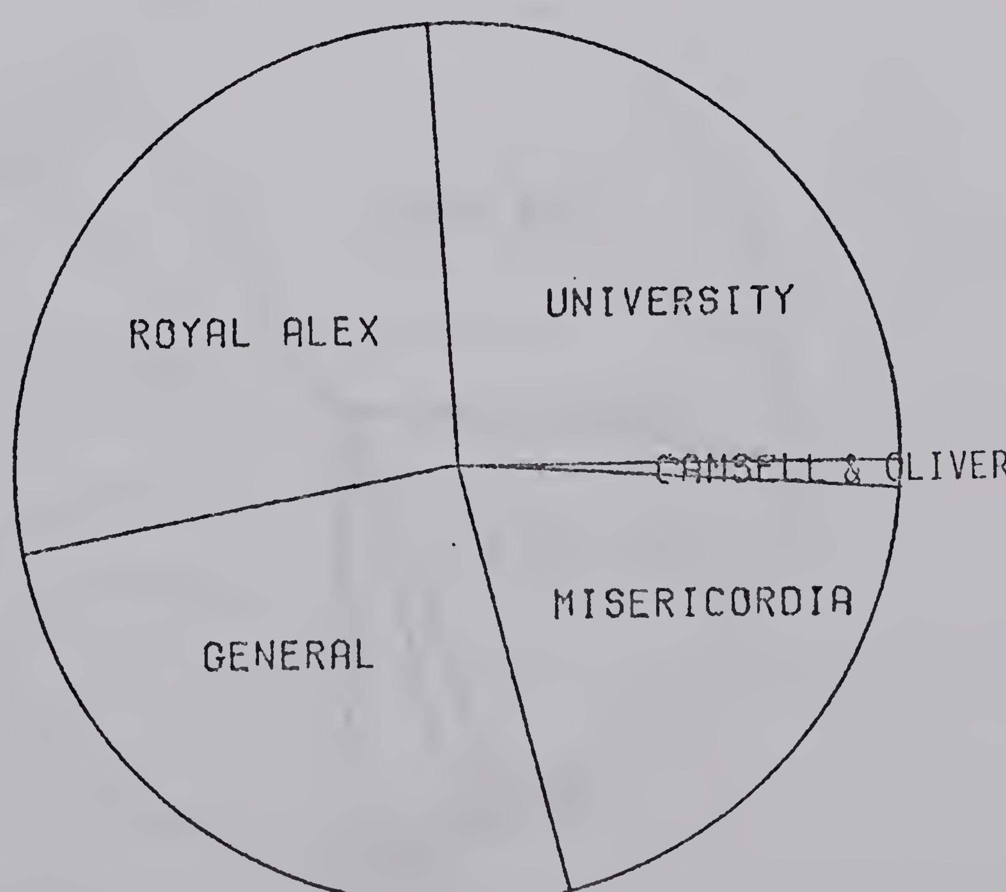
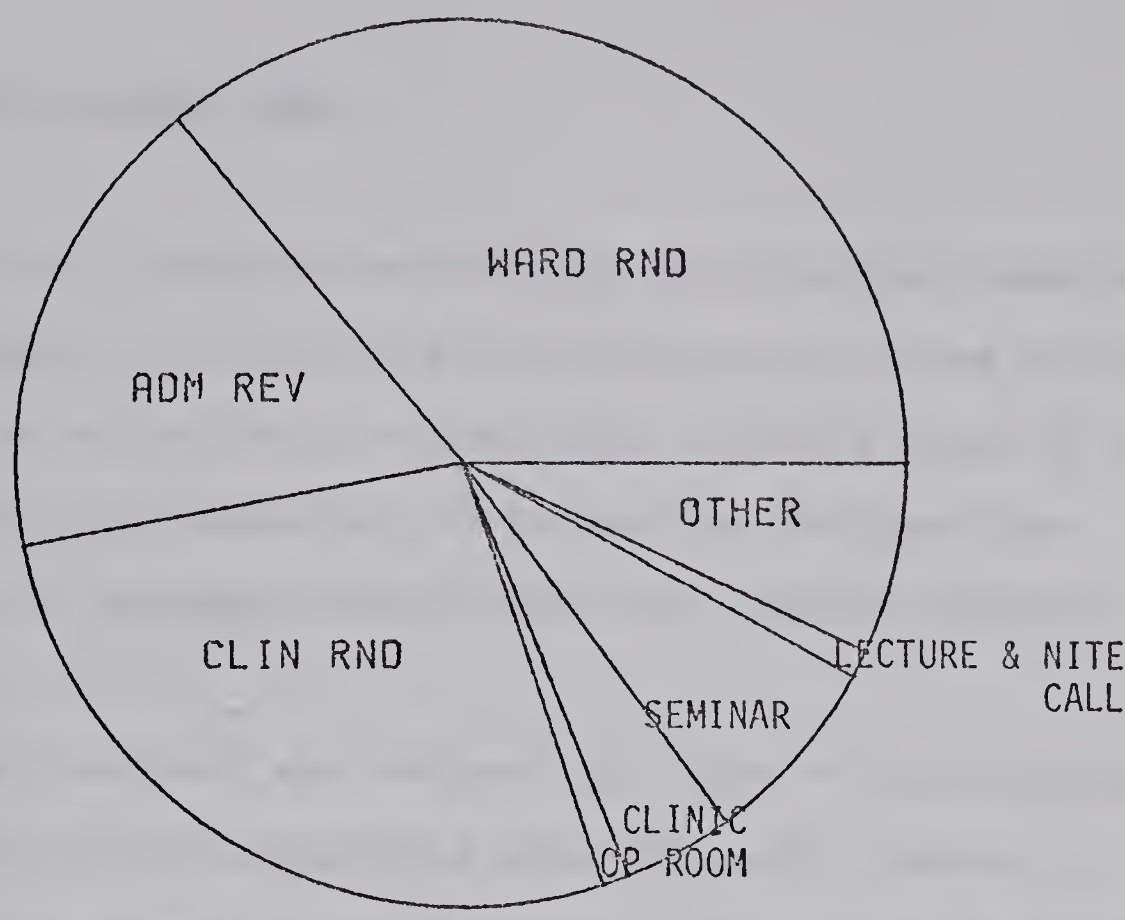
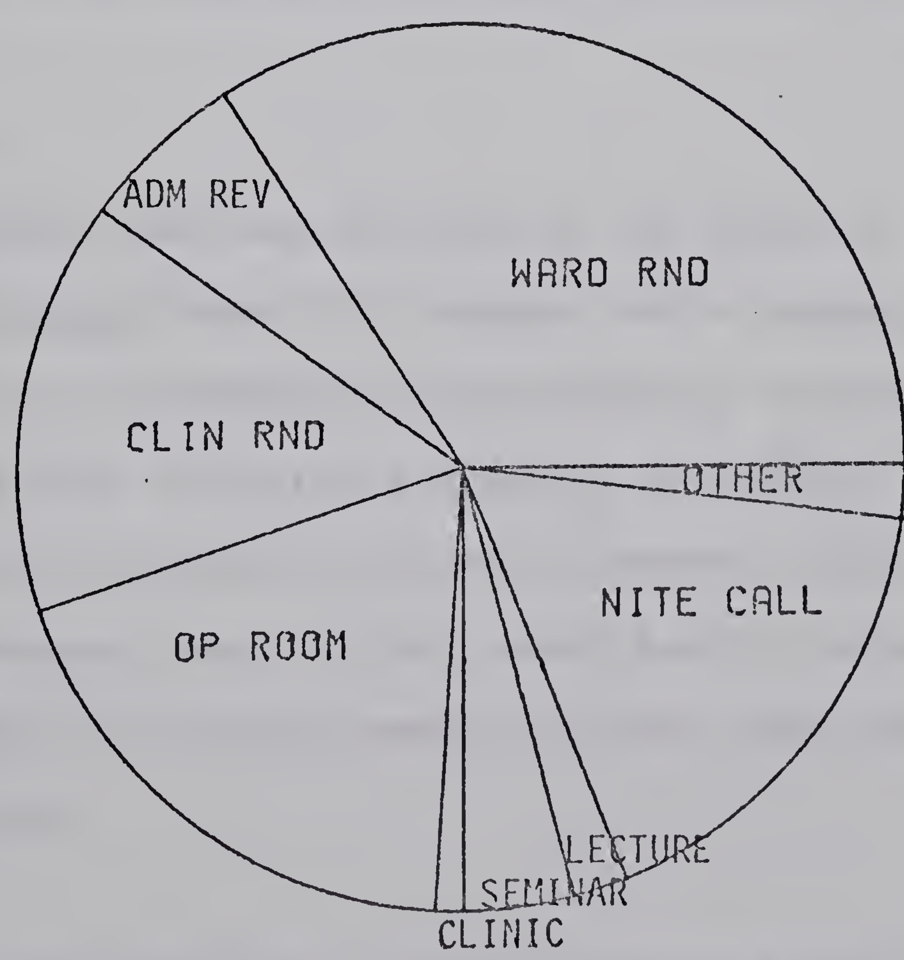


FIGURE 8

INTERN-HOURS BY ACT (ELEC)



INTERN-HOURS BY ACT (ROT)



4.3 Student Contact Time

The three previous sections of this chapter described faculty-student contact from the standpoint of the faculty-members [ie. an estimate of the time actually spent by the faculty with the students]. This section outlines the estimation of student contact time with faculty members.

Student contact was defined in terms of student-hours, and in order to be compatible with the units chosen by Institutional Research and Planning, this unit was further reduced to "Student-hours per student-week". As before, all measurements were tabulated with respect to a one-year time period.

A Student-hour was defined as one hour of contact between a single Phase III student and a member [or members] of the Faculty of Medicine [specifically preceptors, residents and/or rotating interns]. As before, if a student met for one hour with two faculty-members, this constituted only one Student-hour. On the other hand, two students in contact with one faculty-member for one hour described two Student-hours.

Table XIII displays student contact broken down by the

hospital in which rotations were scheduled. Once again, electives were tabulated only in total. Column one lists the participating hospitals, and column two shows the total number of Student-hours logged at each hospital over a one-year period. For example, at the University of Alberta Hospital, there was a total of 60,814 student-hours generated by Phase III students.

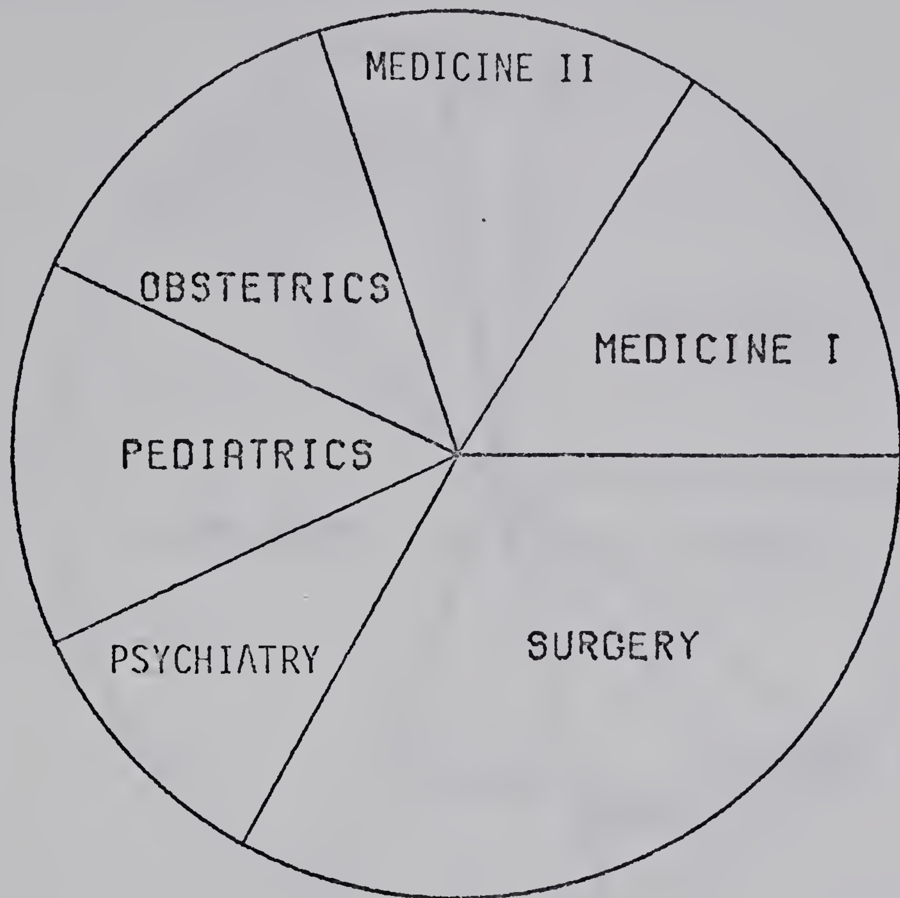
Column three of Table XIII lists the percentage of <u>total Student-hours</u> spent at each hospital, and the fourth column tabulates the estimated number of student-weeks spent at each hospital.

The fifth column of Table XIII displays the number of hours of contact per average student-week, followed by instructional Student-hours, Instructional-hours per student-week, and the proportion of instruction in columns six, seven and eight respectively. As before, "instructional" time is a function of the students' estimates of "Percent Instruction".

A similar tabulation by department follows in Table XIV, as well as tabulations by contact activity for rotations (Table XV) and for electives (Table XVI). Graphic displays of the above can be found in Figures 9 and 10.

FIGURE 9

STUDENT-HOURS BY DEPT.



STUDENT-HOURS BY HOSPITAL

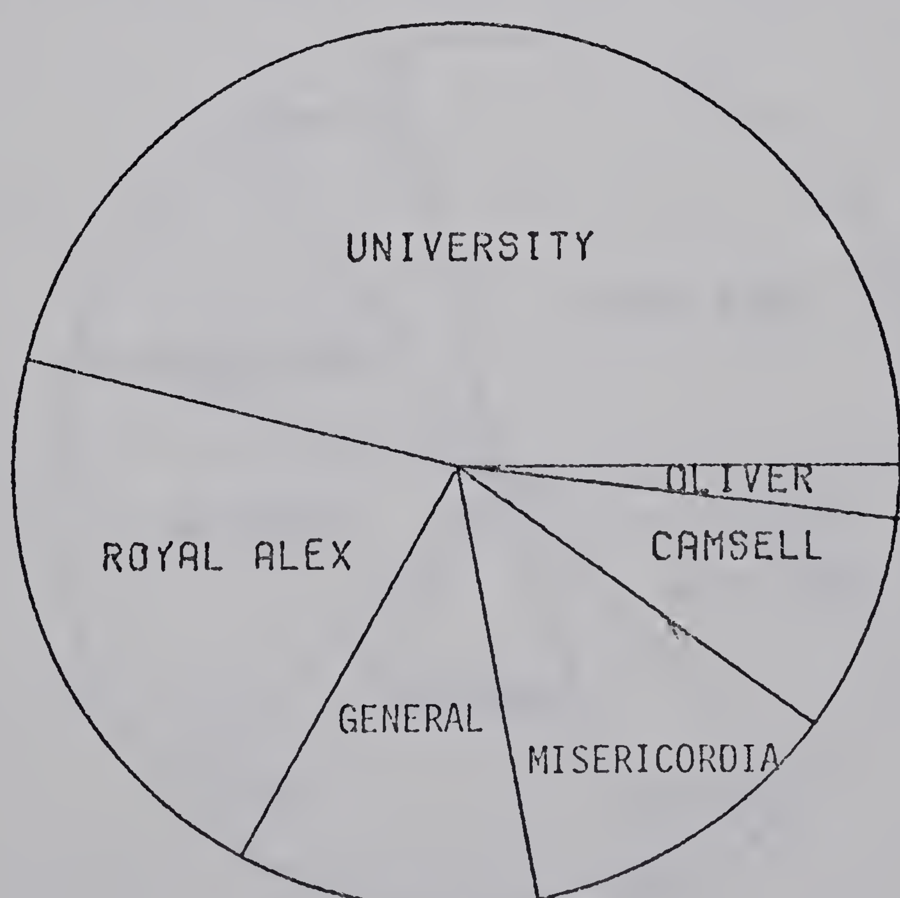
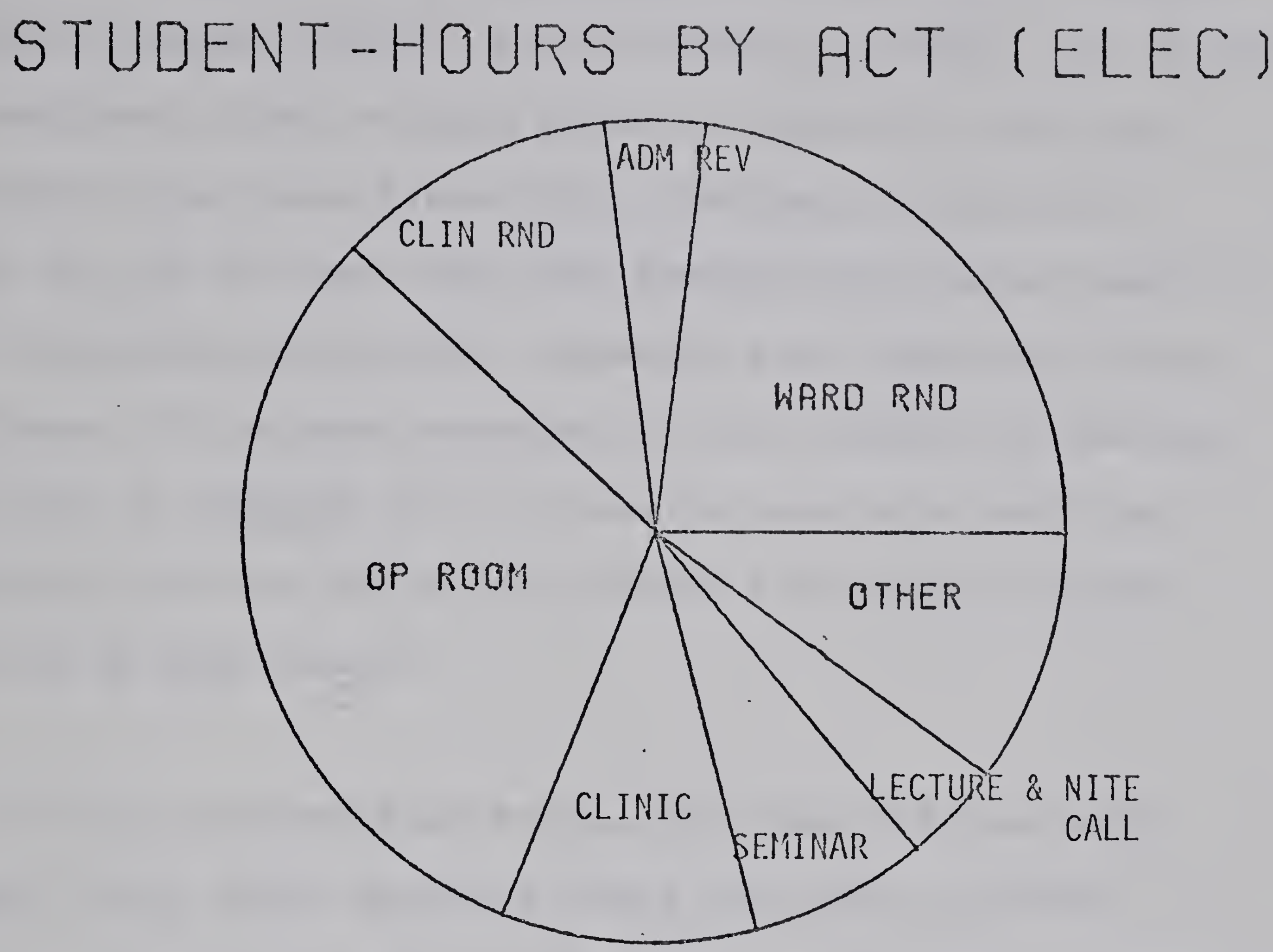
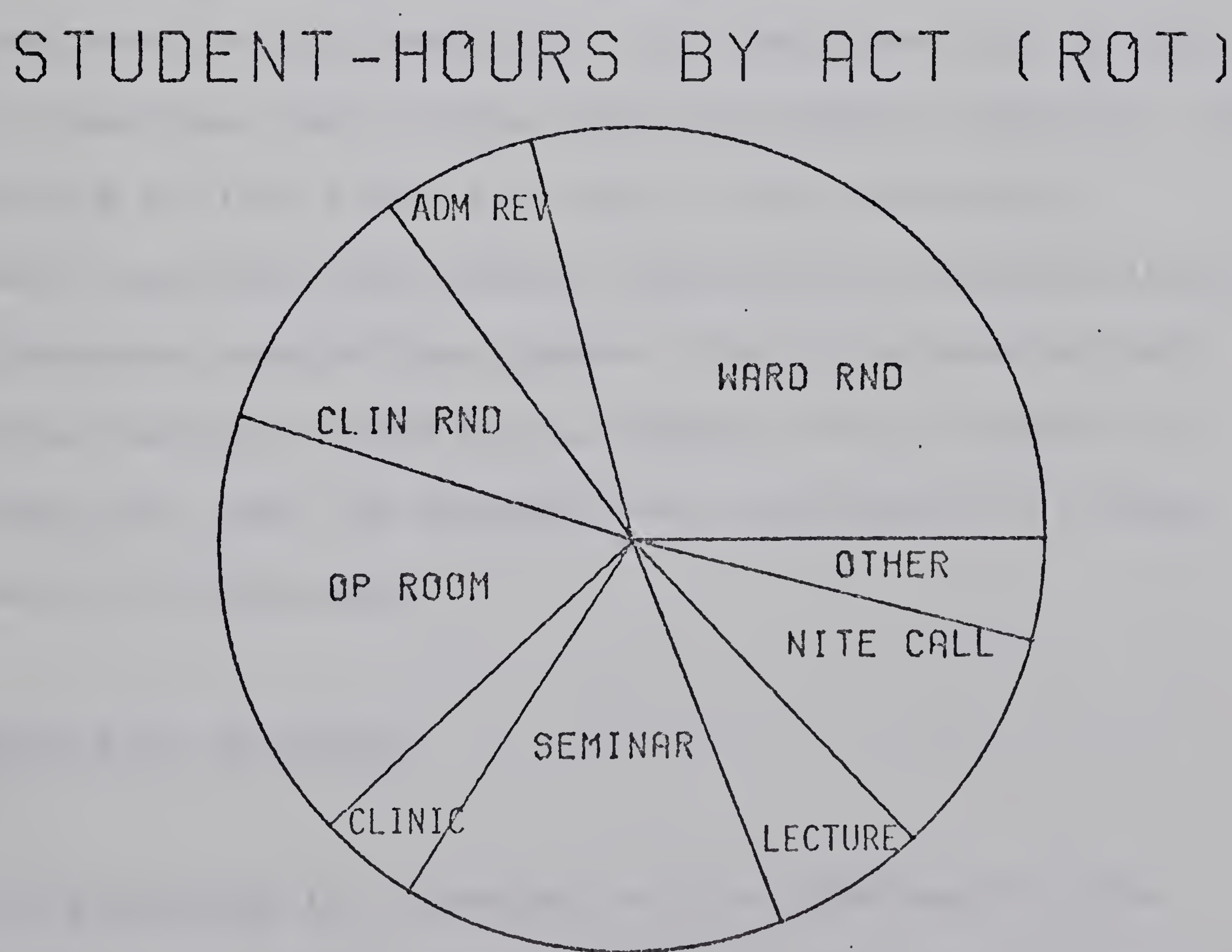


FIGURE 10


STUDENT-HOURS BY ACT (ELEC)
ADM REV
CLIN RND
WARD RND
OP ROOM
OTHER
CLINIC
SEMINAR
LECTURE & NITE CALL


STUDENT-HOURS BY ACT (ROT)
ADM REV
WARD RND
CLIN RND
OP ROOM
OTHER
NITE CALL
SEMINAR
CLINIC
LECTURE

Interpretation can be illustrated in a manner similar to that of Faculty-hours. As an example, consider the 10,288 instructional Student-hours spent on Obstetric Rotations during the year [see Table XIV]. Dividing by fifty-two weeks, it can be shown that 198 Student-hours were spent in that department every week. Assuming that there are, say, 200 Phase III students enrolled in the Faculty, it can be said that an <u>average</u> of 1.0 hours per week are spent in Obstetrics by each Phase III student with direct contact with one or more staff.

One may observe from Tables XIII and XIV that each student spent about thirteen hours per week in direct contact with one or more staff members, and this is more or less the same for all hospitals, and electives. The minimum is 11.7 hours per week at the Edmonton General Hospital, and the maximum is 13.6 hours per week at the University Hospital. The variation amongst hospitals is probably due to the difference amongst departments. There are substantial variations amongst departments, ranging from a maximum of 14.6 hours per week for Surgery, to a minimum of 9.1 hours per week for Psychiatry.

4.4 Summary of Findings

The following is a synopsis of the findings of this study.

4.4.1 <u>Preceptor-Hours</u>

The total contact between Phase III students and preceptors of the Faculty of Medicine, from September 4, 1975 to September 2, 1976, was 136,548 Preceptor-hours. Of this total, 57% of the contact occured during rotations and 43% during electives. The number of instructional preceptor contact-hours totalled 73,228, denoting an instructional factor of 53.6%.

Rotations in Surgery obtained the highest proportion of preceptor contact, reaching 43%. Conversely, the department yielding the greatest proportion of preceptor-instruction was Medicine I [58.0%], and the lowest proportion of preceptor-instruction occurred in Surgery [47.0%].

With respect to the distribution of Preceptor-hours over hospitals, the University of Alberta Hospital claimed the most [37%] of all Preceptor-hours, and the Alberta Hospital (Oliver) claimed the least [2%]. Ward Rounds [31%] and Operating Room [33%] were the activities providing the bulk of preceptor-contact for rotations, and the same held true for elective activities [24% and 33%, respectively].

As one might expect, the greatest proportion of instruction from preceptors occured at Seminars [86.7%], and

the least during Operating Room sessions [41.2%].

4.4.2 <u>Student-Hours</u>

The total number of hours of contact by the Phase III students with faculty over the study year totalled 196,818, of which 55.8% was perceived by the students as being instructional. Instructional contact was highest at the University of Alberta Hospital [13.6 Student-hours per student-week], and lowest at the Edmonton General Hospital [11.7 Student-hours per student-week].

It is interesting to note that the overall proportion of instruction was relatively homogenous over hospitals, as well as over rotations [55%] and electives [57%].

On the average, contact by the students with faculty was 23.0 hours per student-week, and out of this, 12.8 hours [55.8%] were considered instructional. The latter figure is equivalent to, say, four courses per week at three hours per course.

Surgery rotations demanded the greatest student contact with faculty [29.3 hours per week], but the corresponding instructional component [49.6%] was the lowest of all departments, yielding only 14.7 hours of instruction per student-week. The fewest number of hours spent by students

occurred in Psychiatric rotations [16.7 hours per week], of which 9.1 hours were considered of instructional value.

4.5 Estimation of Standard Error

In order to evaluate the reliability of various estimates, and to obtain appropriate statistical interpretation, standard errors were computed for the following estimates:

(1) Total Preceptor-hours
(2) Total Resident-hours
(3) Total Student-hours
(4) Total Instructional Preceptor-hours
(5) Total Instructional Resident-hours
(6) Total Instructional Student-hours

The standard error formula discussed in Chapter 3 is based on a simple random sample (SRS) without replacement within each stratum, as previously defined. However, the sampling plan of the present study was not an SRS, but a modified cluster sampling technique. In spite of this, and in spite of the high degree of non-response encountered in the study, the formula was used to derive an approximation of the standard error. It should be noted that the standard error may be somewhat underestimated, due to the nature of the clustering technique and the problems of non-response.

Tabulations of standard error and related calculations can be observed in Table III. To further illustrate the

Table III

Estimation of Standard Error

(1) Measure	(2) Total	(3) $\Sigma n_h(1-f_h)s_h^2$	(4) Relative S.E. (%)
Preceptor-hours	136,548	11,566,616	5.74
Resident-hours	94,202	7,769,251	7.27
Student-hours	196,818	7,916,590	2.83
Inst. Prec-hrs	73,228	8,135,654	8.37
Inst. Res-hrs	46,060	2,286,014	8.82
Inst. Stud-hrs	109,883	6,079,559	4.33

method by which standard error was calculated, the following steps were used in the case of Total Preceptor-hours.

As previously identified in this chapter, the total number of Preceptor-hours as estimated from the survey results was 136,548. Using stratification by hospitals, departments, rotation weeks, and elective weeks over all student-weeks, the sample variance resulted in 61,405,308 hours squared. The square root, or standard error was found to be 7836.1 hours.

A more meaningful expression of standard error is that of relative standard error, or the coefficient of variation. This is simply the standard error expressed as a percentage

of the total sample estimate. Referring once again to the example, the relative standard error for Total Preceptor-hours was estimated at 5.74% [7,836.1/136,548 x 100%]. Of the six estimates tested for standard error (see Table III), the most consistent was that of Total Student-hours (2.83% relative S.E.). This was expected, mainly because of the large sample size (8,558 student weeks) yielding the largest estimate of total contact time (196,818 hours).

Also expected was the high relative standard error for Instructional Resident-hours. In this case, the estimate of contact time was small (46,060 hours), and the variation amongst the students' estimates of "Percent Instructional Component" was large.

4.6 Opinion Survey of Phase III Students

As a follow-up procedure to the Phase III Faculty-Student Contact Time survey, the author distributed an additional questionnaire to all Phase III students previously surveyed and still remaining in the Faculty of Medicine as at September, 1976. A sample of this questionnaire can be found in Appendix D.

A total of 110 students received the follow-up questionnaire, and out of these 52 returned them completed. This gave a rather disappointing response rate of 47%.

The students were asked general questions about the survey and about the Phase III program. Most respondents reacted favourably to the survey, and found it to be potentially valuable in monitoring the level of faculty-student contact. Only about 10% of the respondents gave negative comments, and these were mainly related to problems such as too little time to fill in survey time-sheets. It must be understood that the opinion survey respondents were more than likely those who originally responded to the primary contact-time survey, and as a result, negative comments regarding the survey are probably underestimated.

Most of the 52 responding students indicated that they had been asked to complete between 2 and 4 time sheets, although some reported that they had completed as many as 6 or 7. Only 2 of the respondents claimed that they had never received a time sheet during the course of the study year. Most of those who didn't return <u>all</u> time sheets to the investigator (48%) indicated that they simply "forgot" to do so (13%), or they were just not sufficiently interested in the study (6%).

The majority of the respondents (85%), as indicated by the opinion survey, felt that the faculty-student study was not too great an imposition on their time. Once again, 85% of the respondents clearly understood the purpose and need

for the study, although some would have preferred a somewhat clearer explanation via more preliminary written material.

Only 65% of the respondents felt that the study actually reflected their student intern activity, and 40% suggested that additional information should have been collected by the investigator. Suggestions included estimates of "clinical teaching time", as well as time spent in "technical sessions".

A majority of the students (65%) rejected the validity of "Percent Instructional Component" as a measure of faculty contact. Interestingly enough, the two measures obtained for instructional utility, as reported in the paper found in Appendix C, demonstrated at the very least, a certain consistency, or reliability, in the students' estimates.

Most respondents felt that a mail strike, which occurred in December 1975, did not hinder their reporting effort. However, survey response rate dropped from 65% to 20% during that period. This inconsistancy can probably be attributed to the fact that respondents on the follow-up questionnaire more than likely represented those Phase III students who responded to the initial questionnaire.

In general, the respondents suggested that subsequent studies investigating faculty-student contact time be

carried out on a regular basis. They were encouraged by the effort demonstrated by the Office of the Dean of Medicine, and felt that more effective staff-student interaction may be related to the amount of administrative interest. However, a number of students suggested a parallel questionnaire format investigating the quality of staff-student contact. They reasoned that effective decision-making by the administration could only be accomplished using a more comprehensive data base.

Although the comments obtained through the opinion survey may or may not be representative of the student population, the information can possibly be useful to researchers attempting further study into faculty-student contact.

4.7 Follow-Up Faculty Survey

Six faculty members participating in the Phase III program were interviewed by the author. An example of a typical interview format is found in Appendix E.

Four of the faculty members knew nothing about the Phase III Faculty-Student Contact Time study, but those who did generally supported it. The faculty members were asked to validate some of the information obtained in the study by commenting on the curricular framework used in their

particular rotation(s) or elective(s). Comments were obtained on the number of staff (resources) available in each Rotation or Elective, as well as comments pertaining to the typical daily activities of a Phase III student under the faculty member's direction.

The author found no consistency amongst the faculty members' responses in terms of rotation or elective formats. It was, however, generally expressed by some faculty members that staff resources were presently overloaded, and that more effort should be spent allocating these resources in an effective manner.

The interviews did not yield any significant conclusions, other than a very general validation of the study results. The author argues that such an analysis is only effective when designed and organized under stringent methodological frameworks. Unfortunately, the faculty interviews did not meet this goal.

The question of validity of this study can be summarized in the following manner. The "independent study" [found in Appendix C] signified a certain degree of reliability amongst the students' assessment of "instructional component", although no such relationship was found with faculty members who commented positively on the overloading of staff resources. However, there may be

evidence of a possible correlation between the student respondents and faculty members, and further study may indeed uncover this fact.

4.8 Summary

The data obtained from the time-sheets over the one-year study period was compiled, edited, coded, and analyzed under rigorous methodological scrutiny. Results were tabulated by rotation and elective activities, as well as by hospital, department, and activity type. Estimation of contact time was organized from the students' standpoint (in terms of Student-hours), and from the faculty's standpoint (by examining Preceptor-, Resident-, and Rotating Intern-hours).

From the above estimates, relative standard error (or coefficient of variation) estimations were derived, ranging from 2% to 9%. These results appeared reasonably satisfactory to the author, and enabled him to make several inferences to the general population that could prove useful to future manpower planning.

Two follow-up opinion surveys were conducted, one with the Phase III students and the other with selected participating physicians. The former survey was most useful in obtaining impressions of the study from the students'

point of view. However, the physician interviews lacked the organization and forsight to be of much use in evaluating the Phase III Faculty-Student Contact Time study.

Chapter 5

SUMMARY AND RECOMMENDATIONS

The Phase III Faculty-Student Contact Time Study involved some 200 students, 60 faculty members, and 3 research personnel, over a time period of 14 months. Approximately 5000 activity records were collected, edited, and stored, and a number of special computer programs were written and used to analyze the data. Yet, despite this extensive resource utilization, the question arose whether or not one can conclude any significant facts from this study. To fairly asses this question, one must examine the initial study objectives, and relate them to the study findings.

5.1 Summary and Evaluation

The primary objective, as stated in Chapter 1, was to estimate the actual amount of faculty-student contact time over both rotation and elective activities. This investigation provided estimates through the use of carefully-defined sampling procedures, and by adjusting the sample results with appropriate weights. The Phase III students were asked to respond over a time period of 52 calendar weeks, and this enabled data to be collected

reflecting the students' perceptions of contact time throughout one year of the academic cycle. Using different sampling strategies, both rotation and elective activities were investigated, and the results were adjusted to allow direct comparisons. In addition, contact time was examined in two perspectives: (1) from the faculty's point of view, in terms of the amount of contact they experienced with the students, and (2) from the students' point of view, identifying their contact with the faculty.

The second objective was to compare contact-time over participating hospitals and departments. In this respect, the population of student-weeks for rotations was stratified into 25 unique hospital-department groups, and samples were obtained from each. The author analyzed data within and amongst these strata in terms of preceptor, resident, intern, and student contact-time. Results showed a significant degree of variation among the groups.

The identification and comparison of direct instruction amongst hospital-department groups was the third objective. This aspect was analyzed in two ways. In the first case, the students were asked to subjectively estimate a percentage of "instructional component" for each identified period of contact. This method produced an adjustment factor which, when applied against the raw data, provided the investigator with an estimate of direct instructional time. The second

method, used in a separate study, instructed the students to rank each Phase III activity in the order of "greatest instructional value", and a subsequent correlation of these results with those of the first method yielded a significant compatability relationship. These independent measures allowed the conclusion to be drawn that, at the very least, the subjective value of the students' assessment of instructional time was consistant. Over all strata, the average instructional component was about 54%, suggesting that, as far as the students were concerned, about half of all contact time was spent in direct instruction.

The final objective was to evaluate the methodology employed in this study. The theoretical rationale for utilizing a sampling design was thoroughly discussed in Chapter 2, as was the rationale for the choice of respondents and the time frame. The practical implications, however, necessitate some further examination.

Given that the time frame was a one-year period, the sampling methodology did present certain potential sources of error. The response rate, although initially high at 80%, dropped drastically after about 12 calendar weeks (to about 51%), and never again regained the previous level. This was about the time that the students began to receive their second and third time-sheets, and at that point they were less willing to participate than at the onset of the study.

In addition, during a 6-week Canadian Postal Workers' strike in December, 1975, there showed a marked drop in response rate, even though the researchers made every attempt to compensate.

Because of this low rate of response and the subsequent presence of "empty cells" in some strata, the replication scheme originally included in the sampling design had to be eliminated from the study methodology. Because of this, the author was forced to exclude a technique which would have provided other estimates of standard error.

Also because of the low response rate, many strata had to be combined in the analysis phase. This was not anticipated in the initial design of the study and, as in any mid-stream adjustment, some reliability of the results was lost. Another aspect that was affected by stratum collapsing was the level of detail of the stratification scheme. The resulting consequence was that the sample did not represent the population as well as it could have.

A major weakness in the sampling design and the analysis of data lies in the absence of a study relating to the effects of time on the measurements obtained. Although provision was made in the stratification scheme to account for this factor, various constraints prohibited the author from determining whether or not systematic differences

existed between, say, measurements obtained during the Winter *vis a vis* measurements obtained during the Summer. As a result, in future study it may be difficult to determine whether a time-frame of less than one year could adequately provide estimates representing an annual cycle of student-faculty contact.

5.2 Recommendations

The following are the author's recommendations for further investigation into Phase III Faculty Student Contact Time. These recommendations are based solely upon the results of the present study.

5.2.1 Recommendation #1

In the author's opinion, the methodology used in this study is (subject to the modifications outlined below) sufficiently adequate to warrant its use in further research of this nature. The results appeared comparable to measures used in faculties other than the Faculty of Medicine, and the author suggests that the information may be useful when applied directly to inter-faculty comparisons. It is recommended that a similar study be repeated by the Faculty of Medicine on a regular, periodic basis, in order to maintain an up-to-date base of data. In doing so, information would not only be valuable for comparing contact

time between faculties, but would also provide a historical data base with which Faculty administrators could observe and monitor system changes over time.

5.2.2 Recommendation #2

Although the students and faculty generally supported the objectives of this study, the rate of response was relatively low. It is recommended that, for any future studies, the possibility of a time-frame of duration shorter than one year be considered, in an attempt to maintain the interest of the respondents. As an example, perhaps a series of cross-sectional studies, say four per calendar year, would be more effective in increasing and maintaining an acceptable rate of response. Other measures might include (1) increased enforcement of students' response, (2) the balancing, or equalization of the number of times a student is called upon to respond during a calendar year, and (3) maintaining more up-to-date records of current addresses of the students. An improved rate of response could facilitate the use of the replication method for estimating standard error, as well as a more extensive (and detailed) stratification scheme. Such a sampling design should incorporate equalized responses from each student.

5.2.3 Recommendation #3

The author recommends that several other independent measures be taken to ascertain the students' assessment of "instructional component" of contact time. The students, the faculty, as well as the author agreed that this facet was a major weak point in the study. It was also pointed out that a more specific definition of "instruction" would help to facilitate more accurate measurements of instructional contact time.

5.2.4 Recommendation #4

It is suggested that survey instruments other than mail questionnaires be evaluated as alternative modes for future study. Alternatives could possibly include the use of interviewers or observers for all respondents in the sample, or the use of sub-samples to control costs. Although the cost would increase, this may help control the response rate and measurement errors, and hence improve the quality of the results.

5.2.5 Recommendation #5

The final, and perhaps the most vital, recommendation

is that, because this study was only of a descriptive nature, the results should be used only as a guideline in the decision-making process. Further normative-type study into the _quality_ of faculty-student contact, as well as into _projected_ contact time under future conditions, should be considered before resource planning becomes dependent on the data resulting from this type of research.

5.3 Future Research

This investigation has provided information concerning the level of resource utilization within the Phase III program. Although the results are useful [and necessary] in establishing an initial data base, the following questions are still unanswered:

(1) What is the _value_ of the present contact between staff and students?

(2) Can the _effectiveness_ of the contact be improved?

(3) How can system slack, or non-instructional contact-time, be evaluated?

Only by answering these questions can decision-makers institute effective change and improve the calibre of the trained medical professional.

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APPENDIX A

Result Tabulations

Table IV

Annual Preceptor-Contact by Hospital

(1) HOSPITAL	(2) Total Faculty Hours	(3) % of Total Hours	(4) Instruct. Faculty Hours	(5) Proport'n of Instruct.
University	29,355	37	15,077	0.514
Royal Alex	16,122	21	7,652	0.475
General	13,978	18	7,732	0.553
Misericordia	10,638	14	4,736	0.445
Camsell	6,476	8	3,448	0.532
Alta. Hosp.	1,225	2	622	0.508
ROTATION TOTAL	77,794	100	39,267	0.505
ROTATIONS	77,794	57	39,267	0.505
ELECTIVES	58,754	43	33,961	0.578
TOTAL	136,548	100	73,228	0.536

Table V

Annual Preceptor-Contact by Department

(1) DEPARTMENT	(2) Total Faculty Hours	(3) % of Total Hours	(4) Instruct. Faculty Hours	(5) Proport'n of Instruct.
Medicine I	3,375	4	1,956	0.580
Medicine II	11,072	14	5,988	0.541
Obstetrics	12,116	16	6,301	0.520
Pediatrics	7,574	10	4,337	0.573
Psychiatry	10,163	13	4,958	0.488
Surgery	33,492	43	15,727	0.470
TOTAL	77,794	100	39,267	0.505

Table VI

Annual Preceptor-Contact by Contact Activity

Activity	Rotations				Electives			
	(1) Total Faculty Hours	(2) % of Total Hours	(3) Instruct. Faculty Hours	(4) Proport'n of Instruct.	(5) Total Faculty Hours	(6) % of Total Hours	(7) Instruct. Faculty Hours	(8) Proport'n of Instruct.
WR	23,909	31	10,343	0.433	13,970	24	9,464	0.678
AR	3,271	4	1,944	0.594	1,888	3	1,339	0.709
CR	9,038	12	5,558	0.615	5,602	10	4,003	0.715
OR	25,243	33	10,395	0.412	20,259	33	9,216	0.455
CL	3,475	4	1,904	0.548	6,207	11	3,333	0.537
SE	4,095	5	3,582	0.875	2,864	5	2,483	0.867
LE	1,899	3	1,646	0.867	925	2	760	0.822
NC	3,322	4	1,863	0.561	177	0	132	0.746
OT	3,542	5	2,032	0.573	6,862	12	3,231	0.471
TOTAL	77,794	100	39,267	0.505	58,754	100	33,961	0.578

WC - Ward Rounds
AR - Admissions Review
CR - Clinical Rounds
OR - Operating Room
CL - Clinics
SE - Seminar
LE - Lecture
NC - Night Call
OT - Others

Table VII

Annual Resident-Contact by Hospital

(1) HOSPITAL	(2) Total Faculty Hours	(3) % of Total Hours	(4) Instruct. Faculty Hours	(5) Proport'n of Instruct.
University	40,708	67	19,163	0.471
Royal Alex	11,659	19	4,970	0.426
General	3,288	5	1,585	0.482
Misericordia	4,532	7	1,561	0.344
Camsell	1,378	2	780	0.566
Alta. Hosp.	29	0	2	0.069
ROTATION TOTAL	61,542	100	28,061	0.456
ROTATIONS	61,542	65	28,061	0.456
ELECTIVES	32,660	35	18,000	0.551
TOTAL	94,202	100	46,060	0.489

Table VIII

Annual Resident-Contact by Department

(1) DEPARTMENT	(2) Total Faculty Hours	(3) % of Total Hours	(4) Instruct. Faculty Hours	(5) Proport'n of Instruct.
Medicine I	12,121	20	5,990	0.494
Medicine II	8,208	13	4,242	0.517
Obstetrics	6,193	10	3,140	0.507
Pediatrics	8,051	13	3,911	0.486
Psychiatry	3,224	5	1,514	0.470
Surgery	23,745	39	9,264	0.390
TOTAL	61,542	100	28,061	0.456

Table IX

Annual Resident-Contact by Contact Activity

	Rotations				Electives			
Activity	(1) Total Faculty Hours	(2) % of Total Hours	(3) Instruct. Faculty Hours	(4) Proport'n of Instruct.	(5) Total Faculty Hours	(6) % of Total Hours	(7) Instruct. Faculty Hours	(8) Proport'n of Instruct.
WR	19,341	31	7,143	0.369	12,963	41	5,691	0.439
AR	4,337	7	2,468	0.569	2,303	7	1,241	0.539
CR	7,683	12	4,882	0.635	3,596	11	2,532	0.704
OR	14,479	24	4,797	0.331	4,347	13	2,519	0.579
CL	1,512	3	1,078	0.713	2,731	8	1,913	0.701
SE	2,683	4	2,272	0.847	3,060	9	2,416	0.789
LE	1,087	2	655	0.603	567	2	484	0.854
NC	8,420	14	3,790	0.450	57	0	57	1.000
OT	2,000	3	975	0.488	3,036	9	1,147	0.378
TOTAL	61,542	100	28,060	0.456	32,660	100	18,000	0.551

WC - Ward Rounds
AR - Admissions Review
CR - Clinical Rounds

OR - Operating Room
CL - Clinics
SE - Seminar

LE - Lecture
NC - Night Call
OT - Others

Table X

Annual Intern-Contact by Hospital

(1) HOSPITAL	(2) Total Faculty Hours	(3) % of Total Hours	(4) Instruct. Faculty Hours	(5) Proport'n of Instruct.
University	6,751	26	3,930	0.582
Royal Alex	6,860	27	3,462	0.505
General	6,795	26	3,977	0.585
Miseracordia	5,154	20	2,125	0.412
Camsell	325	1	132	0.406
Alta. Hosp.	0	0	0	---
ROTATION TOTAL	25,886	100	13,626	0.526
ROTATIONS	25,886	83	13,626	0.526
ELECTIVES	5,345	17	3,284	0.614
TOTAL	31,231	100	16,910	0.541

Table XI

Annual Intern-Contact by Department

(1) DEPARTMENT	(2) Total Faculty Hours	(3) % of Total Hours	(4) Instruct. Faculty Hours	(5) Proport'n of Instruct.
Medicine I	1,686	6	1,173	0.696
Medicine II	6,570	25	3,351	0.510
Obstetrics	2,410	9	1,385	0.575
Pediatrics	4,554	18	2,418	0.531
Psychiatry	1,473	6	690	0.468
Surgery	9,192	36	4,811	0.523
TOTAL	25,886	100	13,622	0.526

Table XII

Annual Intern-Contact by Contact Activity

Activity	Rotations				Electives			
	(1) Total Faculty Hours	(2) % of Total Hours	(3) Instruct. Faculty Hours	(4) Proport'n of Instruct.	(5) Total Faculty Hours	(6) % of Total Hours	(7) Instruct. Faculty Hours	(8) Proport'n of Instruct.
WR	8,755	34	4,135	0.472	1,964	37	867	0.414
AR	1,514	6	756	0.499	890	17	576	0.647
CR	3,795	15	2,577	0.679	1,478	28	1,090	0.738
OR	5,016	19	2,451	0.489	29	1	15	0.517
CL	290	1	126	0.435	212	4	159	0.750
SE	987	4	914	0.926	358	7	315	0.880
LE	505	2	466	0.923	56	1	30	0.536
NC	4,481	17	2,003	0.447	0	0	0	---
OT	454	2	155	0.341	357	7	232	0.650
TOTAL	25,797	100	13,583	0.527	5,345	100	3,284	0.614

WC - Ward Rounds
AR - Admissions Review
CR - Clinical Rounds
OR - Operating Room
CL - Clinics
SE - Seminar
LE - Lecture
NC - Night Call
OT - Others

Table XIII

Annual Student-Contact by Hospital

(1) HOSPITAL	(2) Total Student Hours	(3) % of Total Hours	(4) Total Student Weeks	(5) Total Hours per Student Week	(6) Instruct. Student Hours	(7) Instruct. Hours per Student Week	(8) Proport'n of Instruct.
University	60,814	46	2,369	25.7	32,350	13.6	0.532
Royal Alex	27,554	21	1,217	22.6	15,638	12.8	0.567
General	13,934	11	712	19.6	8,347	11.7	0.599
Misericordia	14,998	12	670	22.4	7,984	11.9	0.532
Camsell	10,350	8	470	22.0	6,232	13.3	0.602
Alta. Hosp.	2,092	2	96	21.8	1,167	12.2	0.558
ROTATION TOTAL	129,742	100	5,534	23.4	71,718	12.9	0.553
ROTATIONS	129,742	66	5,534	23.4	71,718	12.9	0.551
ELECTIVES	67,076	34	3,024	22.2	38,165	12.6	0.568
TOTAL	196,818	100	8,558	23.0	109,883	12.8	0.558

Table XIV

Annual Student-Contact by Department
[Rotation Only]

(1) DEPARTMENT	(2) Total Student Hours	(3) % of Total Hours	(4) Total Student Weeks	(5) Total Hours per Student Week	(6) Instruct. Student Hours	(7) Instruct. Hours per Student Week	(8) Proport'n of Instruct.
Medicine I	21,262	16	862	24.7	11,747	13.6	0.552
Medicine II	17,712	14	850	20.8	10,271	12.1	0.580
Obstetrics	17,350	13	804	21.6	10,288	12.8	0.593
Pediatrics	18,126	14	794	22.8	11,292	14.2	0.623
Psychiatry	13,064	10	784	16.7	7,154	9.1	0.548
Surgery	42,228	33	1,440	29.3	20,966	14.6	0.496
TOTAL	129,742	100	5,534	23.4	71,718	12.9	0.553

Table XV

Annual Student-Contact (Rotation) by Contact Activity

(1) ACTIVITY	(2) Total Student Hours	(3) % of Total Hours	(4) Total Student Weeks	(5) Total Hours per Student Week	(6) Instruct. Student Hours	(7) Instruct. Hours per Student Week	(8) Proport'n of Instruct.
Ward Rounds	38,880	29	5,534	7.0	16,279	2.9	0.419
Admissions Rev.	7,960	6	5,534	1.4	4,534	0.8	0.607
Clinical Rounds	12,584	10	5,534	2.3	8,247	1.5	0.696
Operating Room	21,308	17	5,534	3.8	8,133	1.5	0.395
Clinics	4,662	4	5,534	0.8	2,690	0.5	0.595
Seminars	19,264	15	5,534	3.5	17,257	3.1	0.914
Lectures	7,626	6	5,534	1.4	6,687	1.2	0.857
Night Calls	11,656	9	5,534	2.1	4,986	0.9	0.443
Other	5,802	4	5,534	1.0	2,905	0.5	0.491
TOTAL	129,742	100	5,534	23.4	71,718	12.9	0.553

Table XVI

Annual Student-Contact (Elective) by Contact Activity

(1) ACTIVITY	(2) Total Student Hours	(3) % of Total Hours	(4) Total Student Weeks	(5) Total Hours per Student Week	(6) Instruct. Student Hours	(7) Instruct. Hours per Student Week	(8) Proport'n of Instruct.
Ward Rounds	15,030	23	3,024	5.0	7,727	2.5	0.514
Admissions Rev.	3,022	4	3,024	1.0	1,957	0.6	0.645
Clinical Rounds	7,460	11	3,024	2.5	5,118	1.7	0.686
Operating Room	20,404	31	3,024	6.7	9,376	3.1	0.459
Clinics	6,924	10	3,024	2.3	3,837	1.3	0.554
Seminars	4,676	7	3,024	1.5	4,178	1.4	0.893
Lectures	2,546	4	3,024	0.8	2,204	0.7	0.860
Night Calls	234	0	3,024	0.1	188	0.1	0.803
Other	6,780	10	3,024	2.2	3,580	1.2	0.528
TOTAL	67,076	100	3,024	22.2	38,165	12.6	0.569

APPENDIX B

Survey Instrument

FACULTY OF MEDICINE
OFFICE OF THE DEAN

THE UNIVERSITY OF ALBERTA
EDMONTON, CANADA
T6G 2G3

Phase III Medical Students

Re: Faculty/Student Contact Time: A Survey of the Phase III M.D. Program

You have been selected as a respondant for the week specified on the TIME-SHEETS attached. Please fill out the TIME-SHEETS as accurately as possible.

Should any difficulties arise, please contact Mr. Michael Nusbaum (432 5817 office; 439 7989 home), Research Assistant for the project, or Dr. K.S. Bay (432 6535) of the Division of Health Services Administration, Faculty of Medicine, Rm. 13-104 C.S.B.

In order to facilitate accurate study results, it is imperative that each TIME-SHEET be completed and mailed in as soon as possible. Failure to do so will most definitely invalidate the study, and a great deal of time and money will have been wasted.

For your convenience, a return address label is attached to the back of the TIME-SHEETS. Please fold, staple, and mail the SHEETS promptly upon completion at the end of the week's period.

Thank you for your participation in this research project.

Yours sincerely,

D.F. Cameron, M.D.
Dean, Faculty of Medicine

PHASE III M.D. PROGRAM

The University of Alberta

FACULTY-STUDENT CONTACT TIME SURVEY

Seven-Day Record of Student Contact Time

Purpose

The purpose of this survey is to estimate the total amount of direct FACULTY-STUDENT CONTACT TIME during Phase III for the 1975/76 academic year.

Definition

FACULTY-STUDENT CONTACT TIME is the time taken in formal and informal sessions during which Phase III students are observing or receiving instructions under direct supervision of one or more preceptors and/or other medical staff members, including residents and interns. "Direct supervision" means that the student is in the physical presence, or within sight, of the supervisor.

Instructions

You have been provided a set of TIME-SHEETS (or survey forms) on which you are to maintain a simple chronological record of your FACULTY-STUDENT CONTACT TIME during the seven-day period, starting at 9 a.m. on Thursday of the week. We suggest that you record every day rather than try to fill them out at the end of the week.

Please complete the TIME-SHEET according to the instructions below:

Col. (1) In the boxes provided, write in the day on which the activity takes place. Please use the abbreviations THU, FRI, SAT, SUN, MON, TUE, WED.

Col. (2) Place a check (✓) in the box that describes the activity involved when a FACULTY-STUDENT CONTACT took place. For the sake of consistency, please note that

--WARD ROUNDS include case presentations
--ADMISSIONS REVIEW refers to the review of admitting histories and physicals with a preceptor or resident
--CLINICAL ROUNDS include divisional rounds, departmental rounds, and visits to lab and x-ray
--OPERATING ROOM includes all time spent in the Operating Room and Caseroom
--NIGHT CALL includes only FACULTY-STUDENT contact time during on-call period
--CLINICS, SEMINAR, and LECTURE are self-explanatory activity descriptions. If the activity involves more than one category, please check only the one which describes it the best in your judgement
--OTHER is to be used if no other description is appropriate

Cols. (3)-(6) In Columns (3) through (6), record the average number of preceptors, residents, and interns who were present during the contact activity. Be sure to include yourself when you record the number of Phase III students present. Finally, guest lecturers, etc., are considered "preceptors" for the purposes of this study.

Col. (7) Fill in the box with the length of time, rounded to the nearest 10 minutes, consumed by the activity. Note that the final zero has been filled in for you; thus, if an activity consumes 50 minutes, you would write 5 in front of the zero.

(Cont.)

Col. (8) This column is designed to estimate the proportion of your activities which are relevant to educational purposes. You are requested to provide the estimate according to your best judgement, rounded to the nearest 10 per cent. (The last zero has been filled in.) For example, if the activity is entirely for Phase III students' instruction, 100 per cent (of time) is an appropriate estimate and you should write 10 in front of the zero. On the other hand, if the activity has a dual purpose of patient care and demonstration for students, you may estimate it as 50 per cent (of your time), or any fraction, according to your judgement.

Sampling

In order to minimize your work, sampling methods will be used instead of requesting students to keep a record for the entire year. Consequently, it is expected that one selected student-week will be representing ten student-weeks on the average and the error made in filling out this form will be multiplied by the same factor. Therefore, accurate estimation by the selected student is an essential requirement of this survey and your cooperation will be greatly appreciated.

Example

The attached sheet illustrates a hypothetical TIME-SHEET for the week starting Thursday, September 4, 1975. The hypothetical student, John Smith, spent 4 hours 30 minutes on WARD ROUNDS, 2 hours 30 minutes in CLINIC, and 2 hours in OPERATING ROOM on Thursday. One PRECEPTOR, 2 RESIDENTS, 3 INTERNS, and 4 Phase III students were present at the WARD ROUND, while only one RESIDENT and one Phase III student (John Smith himself) were at the CLINIC activity. John Smith estimates that the educational components were 80 per cent, 100 per cent, and 60 per cent of the time for the WARD ROUNDS, CLINICS, and OPERATING ROOM respectively.

Faculty of Medicine
The University of Alberta

PHASE III M.D. PROGRAM
FACULTY-STUDENT CONTACT TIME SHEET

Phone (B) 452 - 4121 - 201
Phone (H) 499 - 1121

OFFICE USE ONLY

Name SMITH, JOHN

Location (Dept.) U.A.H.

Location (Hosp.) OBG

For the Week Starting

Thursday, SEPT. 1, 1975 01 (C.W.)

0021 - 1
(Sample) (Page)

	(1)	(2) Contact Activity (Please check one)									(3) Average Number of Participants	(4)	(5)	(6)	(7)		(8)
	Day of Week	Ward Rounds	Admissions Review	Clinical Rounds	Operating Room	Clinics	Seminar	Lecture	Night Call	Others	Preceptors Present	Residents Present	Interns Present	Phase III's Present	Direct Contact Time Hours	Minutes	Instructional Component %
01	THU	✓									1	2	3	04	04	30	080
02	THU					✓					0	1	0	01	02	30	100
03	THU				✓						1	1	3	03	02	00	060
04	WED	✓									1	1	2	04	03	00	060
05																0	0
06																0	0
07																0	0
08																0	0
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22																0	0
23																0	0
24																0	0
25																0	0

SAMPLE

Day of Week Abbreviations: MON TUE WED THU FRI SAT SUN

APPENDIX C

An Independent Study

Scaling Techniques and Subjective Evaluation:

Two Measures Estimating the Instructional Utility of the Phase III Program of Medical Education

by

Michael Nusbaum

Division of Health Services Administration

HSA 531

Dr. C.B. Hazlett

May, 1976

I.1 Background to the Problem

The problem of evaluating faculty teaching is common to all universities. A widely-recognized convention of determining professorial- and course-effectiveness is through the use of course-evaluation questionnaires, by which students are asked to comment on the effectiveness of the majcr component parts that compose an instructor-course teaching unit.

However, many faculties and schools [especially graduate faculties] do not follow traditional instructional formats, which usually are made up of lectures, laboratory sessions, and tutorials. In the senior year[s] of medical schools, students undertake an "internship" program, whereby they spend the majority of their time <u>in the hospitals</u> receiving on-the-job training for the various specialties needed to produce general practitioners. At the University of Alberta Faculty of Medicine, students in Phase III [3rd and 4th year] are required to take a fixed number of rotations and electives through selected hospital departments. Rotations are chosen by the faculty administration, and electives are selected by the students themselves.

Within any rotation or elective, a student participates

in a number of activities, by which he or she can observe and execute the various tasks expected of a practicing physician. Such activities may include ward rounds, clinical rounds, admissions review, seminars, lectures, operating room sessions, and night calls.

A concern of the faculty administration is with the effectiveness of the various activities in conveying medical knowledge to the students. The author defines effectiveness, in the context of this paper, as the amount of instructional benefit transmitted, by each of the activities, to the student. Instructional benefit is primarily a subjective measure, but may include (1) the proportion of allotted <u>time</u> spent by a student receiving direct instruction, (2) an estimate of the <u>quality</u> of instruction generated within a particular activity, and (3) an estimate of the value of the <u>activity</u> as an instructional medium.

At the present time, a study is underway primarily investigating Phase III Faculty-Student Contact Time[1]. One

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[1] Portions of this study have been documented as part of a Masters Thesis [unfinished at present], by Nusbaum, M., Division of Health Services Administration, Faculty of Graduate Studies and Research, University of Alberta, Edmonton, Alberta.

of the issues being studied, as an aside, is the amount of instruction received by a Phase III student during his/her participation in the aforementioned activities of rotations and electives. The measure is reported as a percentage of <u>time</u>, with respect to the amount of allotted time, for each activity. In other words, a student is asked to carry a TIME-SHEET around to the various activities scheduled for him/her, for a period of one week. For every activity, the student subjectively esimates the "% Instructional Component", and jots it down on the TIME-SHEET, rounded off to the nearest 10%.

The problem with this type of measure is that the student is assumed to have the ability to <u>accurately</u> place a value on the amount of instructional benefit he/she receives during an activity. Practically speaking, this is very unlikely, and close observation of the Contact Study data reveals a somewhat large dispersion of responses over similar activities.

The author, then, has chosen to apply an <u>independent measure</u> of instructional benefit to the Phase III students, to examine any inconsistancies in the data collected from the Contact Study. The independent method selected, and discussed in this paper, is Scaling.

I.2 Statement of the Problem

As previously stated, the Contact Study presumed a degree of expertise on behalf of the respondents, who were asked to report instructional benefit over a student-week[2].

As for the independent scaling measure, students were asked to report their general opinions of the activities over their entire experience in the Phase III program.

This paper will attempt to answer the following questions:

(1) Is it relevent to ask students to comment on the instructional benefit of an activity on a weekly basis as compared to a general opinion over all Phase III experience?

(2) Do the two independent measures correlate significantly, indicating reliability of response?

(3) What are the potential hazards and sources of error in asking the students to respond

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[2] A student-week is defined as a period of seven consecutive days spent by a Phase III student as part of his/her formal rotation or elective schedule.

by each of the methods?

(4) What inconsistancies are present between the two methods, and can any inferences be made at all?

I.3 Definition and Classification of Scales

Measurement has been defined as "the process which permits the quantification of the variables so that relationships may be identified" [Ware and Benson, 1975, p.576]. Three stages of measurement were identified by Lord and Novick [1968] as (1) selection of the object to be measured, (2) identification of the property to be measured, and (3) determination of the numerical assignment rule.

Several authors have attempted to categorize "rules" according to their mathematical properties. Torgerson [1965] identified characteristics of order, distance and origin, and developed four types of scales: ordinal, ordinal with a natural origin, interval, and ratio. Stevens [1968] also identified four scale types: nominal, ordinal, interval, and ratio.

Nominal scales are those whereby elements to be measured are merely classified qualitatively. Ordinal scales denote rank ordering of elements with respect to some property. Interval scales "permit statements concerning the equality of differences, in addition to statements about

ordinal position and equality" [Ware and Benson, 1975, p.576]. Ratio scales differ from interval scales only in that they relate to a unique natural origin [Torgerson, 1965].

Scales based on distance [interval and ratio] require three developmental conditions [Torgerson, 1965]. First, the elements must be able to be ordered in a "quasiserial" fashion. Secondly, deductions must be made concerning the behavior of ratios of real numbers. Finally, an experimental test must be made to determine whether the distances [or ratios] between elements behave in the same manner as the differences [or ratios] between real numbers. If so, the elements may be assigned real numbers.

I.4 The Law of Comparative Judgement

According to Torgerson [1965], Thurstone's Judgement Scaling Model is based on the Law of Comparative Judgement. The model states that, if a series of stimuli are given to a subject, the subject can respond differentially with respect to some given attribute. The researcher's task is to locate these stimuli on a psychological continuum [or scale] in such a way as to account for the responses given by the subjects.

The Law of Comparative Judgement is merely a set of

equations relating the "proportion of times a stimulus k is judged greater on a given attribute than any other stimulus j" [Torgerson, 1965, p. 159]. The equations are based on the following assumptions:

> (1) Each stimulus, when presented to a subject, gives rise to a "discriminal process"[3] which has some value on the psychological continuum of interest.
>
> (2) Due to momentary fluctuations of a subject in his reactions to stimuli, a given stimulus may excite a discriminal process with a higher or lower value on the continuum than may expected. It is postulated, however, that the values of the discriminal processes are such that the frequency distribution is normal on the continuum, and each stimulus has a normal distribution of discriminal processes associated with it.
>
> (3) The mean and standard deviation of the distribution associated with a stimulus are taken as its scale value and discriminal dispersion, respectively.
>
> (4) If two stimuli were presented together to the subject, each would excite a discriminal process. The difference in discriminal processes for any single pair of stimuli is called a discriminal difference.

The distributions of discriminal processes can be

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[3] A discriminal process is that process by which the subject identifies, distinguishes, or reacts to stimuli.

represented graphically, and is shown in Figure 1.

The complete form of the Law of Comparative Judgement is given by the following equation:

$$\boxed{Sk - Sj = Xjk(\sigma j + \sigma k - 2Rjk\sigma j\sigma k)}$$

where:

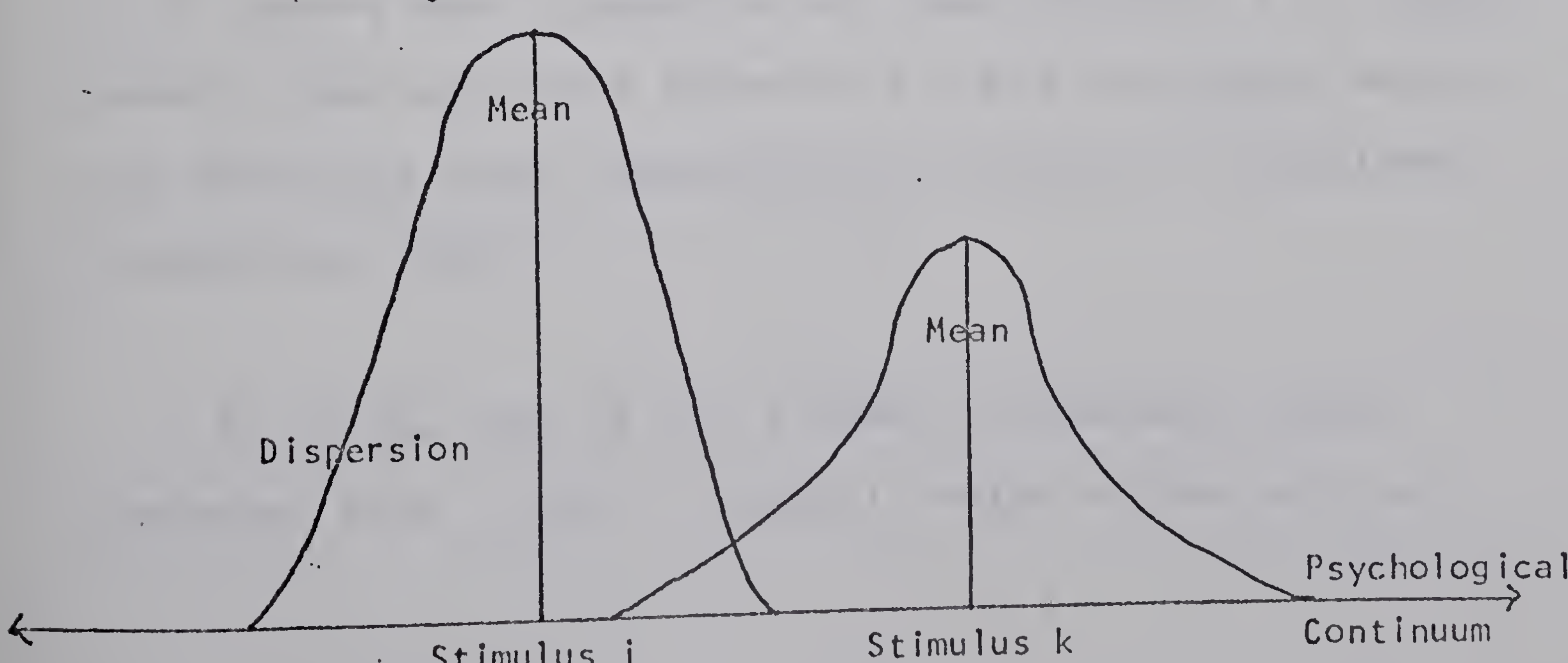
Sj, Sk denote the scale values of stimuli j and k.

σj, σk denote the discriminal dispersions of stimuli j and k.

Rjk is the correlation between the pairs of discriminal processes.

Xjk is the normal deviate corresponding to the theoretical proportion of times stimulus k is judged greater than stimulus j.

Figure 1: Discriminal Dispersions



I.5 Purpose of the Study

The purpose behind this study was to construct a scale of rotation and elective activities, such that the scale values rest on a continuum representing instructional benefit.

CONTINUUM

<-->

less instructionally beneficial ... more instructionally beneficial

I.6 Experimental Procedure

Overton and Hazlett [1976] suggest various methods of developing a scale, including ranking, sorting, single-stimulus rating, and paired comparisons. The Law of Comparative Judgement requires data structured in such a way as to convey "the proportion of times stimulus k is judged greater than any other stimulus j", and the <u>direct</u> method for obtaining these proportions is by paired comparisons [Torgerson, 1965].

It is the task of the subject to indicate, when presented with a pair of stimuli, which of the pair is

greater with respect to the attribute to be scaled. The subject must select only one of the stimuli as being greater, and ties are not allowed.

According to Overton and Hazlett [1976], the method of paired comparisons is advantageous because (1) it forces the subject to make a definitive choice, and (2) it does not force transitivity on the data, in that the subject may not desire to select Stimulus A as being the greater of the pair for all pairs in which it appears.

In addition, paired comparison selection is of the <u>lowest</u> <u>order</u> in terms of the expected expertise required from the subject. In other words, the task of choosing one from a pair is much clearer to understand and carry out than, say, putting a <u>value</u> on stimulus.

Paired comparisons is disadvantageous as a method in that a subject must compare every stimulus to every other stimulus, and this becomes a likely source of fatigue, and hence error.

I.7 Subjects Included in the Study

The subjects chosen to be included in this study were 122 Phase III students in the Faculty of Medicine at the University of Alberta <u>who had been positive respondents to</u>

the Contact Time Study*. It was presumed that the majority of the subjects selected had partaken in each of the activities at least once during their Phase III experience.

I.8 Stimuli

The stimuli, or objects, presented to the subjects were the 7 most frequently-attended rotation/elective activities: ward rounds (WR), admissions review (AR), clinical rounds (CR), operating room (OR), seminars (S), lectures (L), and night calls (NC).

I.9 Attribute

The attribute of interest to the author was the amount of instructional benefit obtained by the subjects while attending the activities in question. Instructional benefit included (1) the utilization of allotted time in direct instruction, (2) the quality of instruction received by the subject, and (3) the utility of the activity as a mode of

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* The subjects comprised a 100% sample of those who had responded to the Contact Time Study. The sampling used for the Contact Time Study was a two-stage, stratified, cluster sample, and details on this sampling plan are available from the author.

instruction. Also, the attribute related to the subjects' general opinion over his/her entire experience as a Phase III student.

I.10 Simplifying Condition

As Torgerson [1965] suggests, conditions are required to further simplify Thurstone's model in order to obtain a workable set of equations. This study utilized simplifying Condition B, which makes the assumption that correlation terms [Rjk] are all equal, and that differences between discriminal dispersions [O<+j-O<+k] are small.

I.11 Research Instrument

The research instrument took the form of a one-page questionnaire, distributed with a cover letter. The questionnaire was divided into two sections.

The first section asked the student to check off which of the 7 activities he/she had ever participated in during Phase III.

The second section presented the subject with a list of paired comparisons for the 7 activities. This required the subject to compare 21 pairs [7!/(7-2)!2!] of activities, and indicate for each, the one of greatest instructional

benefit. The order in which the pairs appeared on the instrument was randomized for each of the 122 subjects, primarily to compensate for fatigue error. This was accomplished through the use of a FO</RTRAN computer program, which generated each questionnaire individually, and with complete randomization.

I.12 Data Collection

The research instrument was distributed by mail to the 122 subjects, and each included a stamped, return-addressed envelope. The number of returned questionnaires totalled 103, giving a response rate of 84.4%.

The returned instruments were coded and keypunched on computer data cards. Through the use of SPSS[5], it was found that 66 of the 103 subjects [64%] had indeed attended all the specified activities, 17 [17%] had attended 6 of the 7 activities, 2 [2%] attended 5 out of 7, and the remainder [17%] either attended fewer than 5 activities, or ommitted answering one or more of the comparisons.

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[5] A computerized Statistical Package for the Social Sciences, McGraw-Hill, 1975.

I.13 Three Basic Matrices

The procedure for calculating scale values utilized three matrices: F, P, and Z. Matrix F indicated the number of times a stimulus k was judged greater than a stimulus j. In other words, F12 represents the number of times activity 2 was judged more instructionally beneficial than activity 1. By definition, the F-matrix is symmetrical, in that F12 + F21 = N = 103.

Matrix P was constructed directly from Matrix F, and represents the <u>proportion</u> of times stimulus k was judged greater than stimulus j. The P-matrix is also symmetrical, and corresponding elements sum to unity.

The transformation matrix, Matrix Z, is a direct consequence of Matrix P. An element Zjk is the unit normal deviate corresponding to the element Pjk, and is obtained by referring to a table of areas under the unit normal distribution curve.

The three matrices obtained from the study data can be found in Table 1.

TABLE 1

Paired Comparisons of Rotation/Elective Activities by Phase III Medical Students with repect to Instructional Benefit

Matrix F: The number of times each activity (k) was judged greater by Phase III students, with respect to instructional benefit, than other activities (j).

k=	WR	AR	CR	OR	S	L	NC
j=WR	0	55	72	36	84	66	35
j=AR	31	0	61	34	68	54	29
j=CR	29	24	0	26	71	35	17
j=OR	50	43	60	0	72	59	36
j= S	17	20	29	14	0	15	14
j= L	32	32	63	28	87	0	24
j=NC	67	59	84	54	89	78	0

TABLE 1 [continued]

Matrix P: The proportion of times each activity (k) was judged greater than other activities (j).

k=	WR	AR	CR	OR	S	L	NC
j=WR	0.0	0.639	0.713	0.419	0.832	0.674	0.343
j=AR	0.361	0.0	0.718	0.442	0.773	0.628	0.330
j=CR	0.287	0.282	0.0	0.302	0.710	0.357	0.168
j=OR	0.581	0.558	0.698	0.0	0.837	0.678	0.400
j= S	0.168	0.227	0.290	0.163	0.0	0.147	0.136
j= L	0.327	0.372	0.643	0.322	0.853	0.0	0.235
j=NC	0.657	0.671	0.832	0.600	0.864	0.765	0.0

TABLE 1 [continued]

Matrix Z: Estimates of differences between scale values for each pair of activites (k-j).

k=	WR	AR	CR	OR	S	L	NC
j=WR	0.0	0.357	0.561	-0.205	0.961	0.449	-0.404
j=AR	-0.357	0.0	0.575	-0.147	0.748	0.326	-0.441
j=CR	-0.561	-0.575	0.0	-0.517	0.553	-0.366	-0.961
j=OR	0.205	0.147	0.517	0.0	0.983	0.462	-0.253
j= S	-0.961	-0.748	-0.553	-0.983	0.0	-1.049	-1.099
j= L	-0.449	-0.326	0.366	-0.462	1.049	0.0	-0.721
j=NC	0.404	0.441	0.961	0.253	1.099	0.721	0.0

I.14 Scale Values

The analytical procedures for obtaining scale values from the Z-matrix, under simplifying Condition B, are discussed in Torgerson [1965, pp.179-185]. Table 2 shows the resulting scale values obtained from the collected data.

TABLE 2

Scale Values for Each Rotation/Elective Activity

	Rotation/Elective Activities						
	NC	OR	WR	AR	L	CR	S
Scale Values	-0.554	-0.295	-0.246	-0.101	0.078	0.347	0.770

I.15 Goodness of Fit

A goodness of fit test was performed on the estimated scale values. The purpose of the test was to determine

whether or not the attribute in question [the amount of instructional benefit] could be utilized in determining scale values, given actual data. In other words, the test was used to demonstrate whether or not the distances between the activities on the scale [according to the attribute] behaved in the same manner as the differences between the real number scale values.

According to Mosteller [1951], who developed a goodness of fit test for scaling, a χ^2 can be obtained through the use of an inverse-sine transformation [see Torgerson, 1965, pp. 185-7]. Mosteller's formula yielded a χ^2 of 25.12198 for the Phase III data. Tested against the null hypothesis with alpha=0.05 and with [(n(n-2)/2)-2n-1] degrees of freedom [$_{.05}\chi^2_6$ =12.6], the null was rejected, indicating that the data was <u>not</u> a good fit to the theoretical model.

Because the author was uncertain as to the influence of missing data[6] on the results of the test, the scale was recalculated using N=64 [all subjects had participated in all the activities, with no missing data]. Once again, the

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[6] Some respondents had not participated in <u>all</u> the activities, some failed to select only one of the ordered pairs, and still some neglected to select either of the ordered pairs.

null hypothesis was rejected [$\chi^2 = 14.40543$, ${}_{.05}\chi^2_6 = 12.6$].

The test results indicated that the scaling technique utilized in this study was not appropriate in terms of accurately assessing instructional benefit of Phase III activities. However, as long as the reader is aware of this inconsistancy, the author will assume, for the remainder of this paper, that the null was accepted, and that the estimated scale values did indeed fit the theoretical model.

I.16 Phase III Faculty-Student Contact Time Study

For comparative [and illustrative] purposes, the "% Instructional Components" of the FSCT study were simply averaged, to form a scale, for each of the contact activities attended by the students from September 4, 1975 to March 31, 1976. These averages can be found in Table 3.

TABLE 3

Average % Instructional Component for Each Rotation/Elective Activity

	Rotation/Elective Activities						
	NC	WR	OR	AR	CR	S	L
Avg % Inst. (N)	37 (133)	41 (813)	42 (347)	50 (215)	63 (378)	88 (456)	90 (207)

Care was taken so that all of the respondents to the Scaling instrument were also included in the FSCT study results reported. A bias did emerge, however, in that the respondents sampled in the Scaling study were all positive respondents to the FSCT study, indicating a false-willingness to participate.

I. 17 Spearman Rho

A Spearman's Rho [Rs] was calculated with respect to the two scales [ie. from the Scaling method and from the Averaged % Instructional Components]. Rs is defined as a non-parametric, rank-order correlation coefficient, indicating that no assumptions are made regarding the distribution of cases on the variables [such as there are with interval and ratio scales]. Nie [1975, p.289] denotes Rs as the sum of the squared differences in the paired ranks for two variables over all cases, divided by the sum of the squared differences in ranks [assuming the rankings are independent].

The correlation was performed with N=7 [activities], and gave a value of:

$$\boxed{Rs = 0.85714}$$

I. 18 Pearson r

The Pearson r is defined as the product-moment

correlation for pairs of variables, and is used to measure the strength of their relationship in terms of the parametric properties. Nie [1975, p.277] refers to the Pearson r as a zero-order correlation, due to the fact that no controls for the influence of other variables are made. Strength of relationship indicates: (1) a goodness of fit of a linear regression line to the data, and (2) the proportion of variation [r^2] of one variable explained by the other.

Again, r was calculated with N=7, and the result was:

$$\boxed{r = 0.817073}$$

$$\boxed{r^2 = 0.6676}$$

I.19 <u>Comments on the Two Scales</u>

Due to the parametric nature of each of the constructed scales [in that they both are characterized by distances between scale values, and not merely by rank order], the Pearson r is the highest-order correlation coefficient available, and is therefore the most appropriate one to use.

When a one-tailed T-test was applied to the value of r with 5 degrees of freedom, the null hypothesis [Ho: r=0] was rejected [Tcr=0.669]. A two-tailed test also yielded a significant result [Tcr=0.754], indicating a strong positive correlation between the two scales. However, because of the low value for N [=7], reliability assumptions could only be made on an inferential basis.

The question of whether or not it is relevant to ask students about instructional benefit of contact activities on a weekly basis compared with a basis of overall experience, can be answered affirmatively. Because the two scales correlated significantly, and because the proportion of variation accounted for by the two scales [r^2] was quite high [67%], it is safe to assume that the two independent measures of instructional benefit did indeed seek the same attribute, and responses from the FSCT study are more or less reliable.

It must be noted that the goodness of fit test performed on the Scaling results indicated that the model was violated. A remedy to this violation may rest in changing the definition of "instructional" benefit to "educational" benefit. An alteration such as this could possibly strengthen the relationship between the attribute and the stimuli. However, any comparison with the FSCT study would be invalidated by the change, because the latter

strictly reported values of "instruction".

I.20 Summary

In conclusion, given the constraints of the two independent measures, it can be stated inferentially that there is a significant degree of reliability between the responses of the two studies, and that Phase III students who react positively to the instruments are, at the least, consistant in their responses.

Unfortunately, the Scaling model was violated, but with some definition modification, it could be repeated more successfully at some future point in time.

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APPENDIX D

Phase III Opinion Survey

DIVISION
ALTH SERVICES ADMINISTRATION
TELEPHONE (403) 432-6437 AND 432-6309

THE UNIVERSITY OF ALBERTA
EDMONTON, ALBERTA, CANADA
T6G 2G3

31 August, 1976

Phase III Students (4th Year)
University of Alberta
Faculty of Medicine

Dear Students:

Re: Phase III Faculty-Student Contact Time Study

Twelve months have passed since you were first imposed upon to participate in the Phase III Faculty-Student Contact Time Study. During that time, 817 TIME-SHEETS were mailed out, and a good proportion of them have been completed and returned.

At the present time, the collected data is being analyzed, and some very interesting results are emerging. Those of us who have been involved with the study wish to take this opportunity to express our gratitude for your participation.

In order to evaluate the study in its entirety, we ask you to complete just one more task. Attached is a SHORT questionnaire asking you to criticize and comment on the content of the study and the method by which it was carried out. Please take the time to answer all the questions as honestly and accurately as possible. When you have finished, fold, staple and mail the questionnaire back to us. In addition, should you have any TIME-SHEETS that are completed and not yet submitted, please mail these in as well.

Again, many thanks, and the best of luck in all your future endeavors.

Sincerely,

Kyung Bay   Michael Nusbaum

Kyung S. Bay, Ph.D.   Michael Nusbaum, B.A.Sc.
Associate Professor   Study Coordinator

KSB:jlc

Encls.

PHASE III FACULTY-STUDENT
CONTACT TIME STUDY
FOLLOW-UP QUESTIONNAIRE

1. Have you ever received a Contact Study TIME-SHEET?

   ☐ YES

   ☐ NO (If NO, you need not answer any more questions. Please mail in the questionnaire and accept our thanks).

2. How many Contact Study TIME-SHEETS have you received in the past 12 months? ☐☐

3. How many have you filled out and returned? ☐☐

4. Do you feel that the study was too great an imposition on your time?

   ☐ YES

   ☐ NO

5. Did the study investigators make it clear to you the purpose and justification for this study?

   ☐ YES

   ☐ NO

   If not, suggest how this may be improved in future studies:

   ____

   ____

   ____

   ____

6. Did you:

   ☐ carry the TIME-SHEETS with you during the week?

   ☐ fill out the TIME-SHEETS at the end of the week?

   ☐ fill out the TIME-SHEETS later than at the end of the week?

   ☐ not fill out the TIME-SHEETS?

7. Did you have difficulty in understanding the instructions as to how to fill out the TIME-SHEETS?

   ☐ YES

   ☐ NO

8. Do you feel that the TIME-SHEETS actually reflected your student-intern activity as far as direct faculty contact time is concerned?

☐ YES

☐ NO

9. Do you feel that the TIME-SHEET should gather any additional information not already being collected?

☐ YES

☐ NO

If YES, what information?

____

____

10. Do you feel that the mail strike last November seriously affected whether or not you submitted the TIME-SHEET?

☐ YES

☐ NO

11. Can you suggest how the TIME-SHEET might be redesigned in the future to improve its clarity and/or function?

____

____

____

12. Do you feel that estimates of "% Instructional Component" are a realistic measure of Faculty contact?

☐ YES

☐ NO

Comments: ____

____

____

13. Have you filled out ALL TIME-SHEETS that you have received?

☐ YES, I have done so.

☐ NO, I have not, because:

- ☐ I was too busy!
- ☐ I forgot about it.
- ☐ I lost the TIME-SHEET.
- ☐ I was not interested.
- ☐ There are too many surveys.
- ☐ I saw no use for this study.
- ☐ Other (specify): ____________________________

14. The Contact Time study only attained about a 50% response rate. In general, how might the study be carried out at a future date to improve the rate of response?

15. Do you have any general comments and/or criticisms?

PLEASE FOLD, STAPLE, AND MAIL.

APPENDIX E

Physician Interview Format

UNIVERISTY OF ALBERTA
FACULTY OF MEDICINE

Phase III Faculty-Student Contact Time Study

MD Name: Date:

Hospital: Dept.:

students: Teaching Appt.:

1. Define the Activities in which students participate in an average Student-Week:

2. State the goals and objectives of your particular program in terms of the above activities:

3. What proportion of time to the students spend at:
   Ward Rounds:
   Admissions Review:
   Clinical Rounds:
   Operating Room:
   Clinics:
   Seminar:
   Lecture:
   Night Call:
   Other [Specify]:

4. What staff [resources] are available to the students interns?
   # Preceptors: Needed:
   # Interns: Needed:
   # Residents: Needed:

5. Any comments about the Phase III Program?

6. Any comments about the Study?